SCIENTIFIC AMERICAN

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THE MANCHESTER SHIP CANAL.

We devote considerable space in our present number to illustrations of this remarkable enterprise, which justly ranks among the great engineering works of modern times.

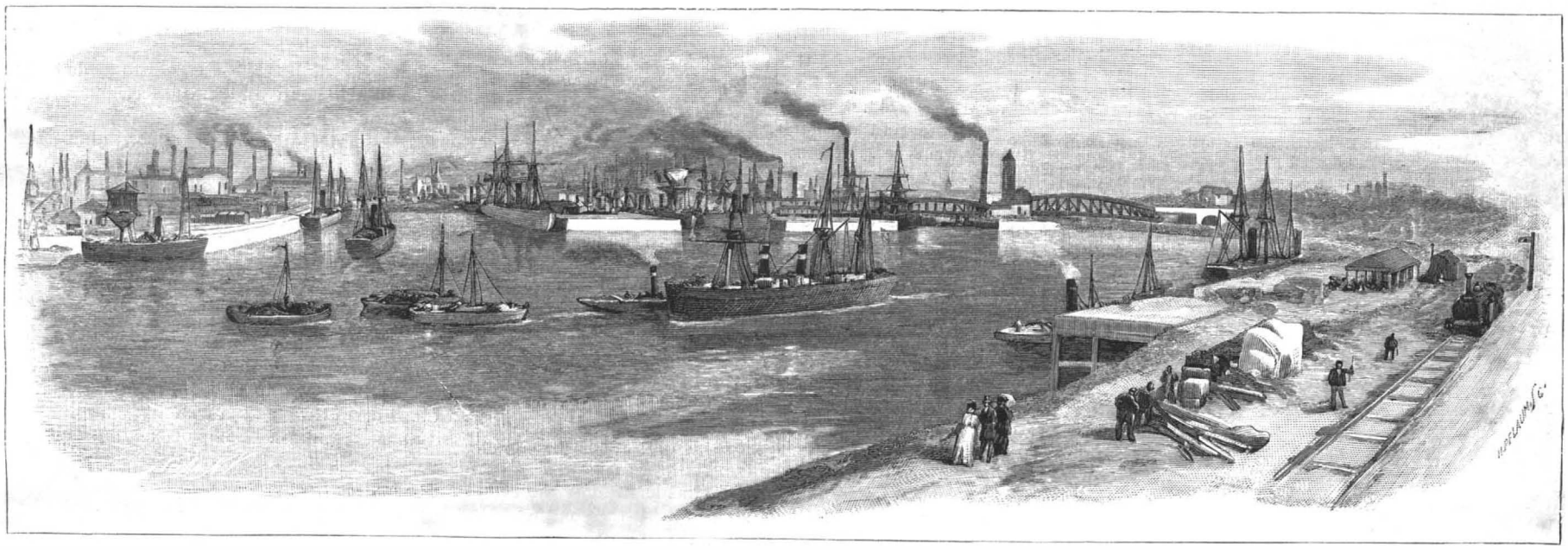
The bird's eye view of the canal and the adjacent country through which it passes will give a fair idea of its locality and the difficulties which were encountered in its realization. We are indebted to *The Graphic*, London, for our bird's eye view and to *Black and White* for the other illustrations and many of the following particulars:

The cost, after various careful estimates, was originally fixed at fifty millions of dollars—$50,000,000; but the construction has actually required $75,000,000. The work is now practically completed and was thrown open to the trade of the world on January 1, 1894.

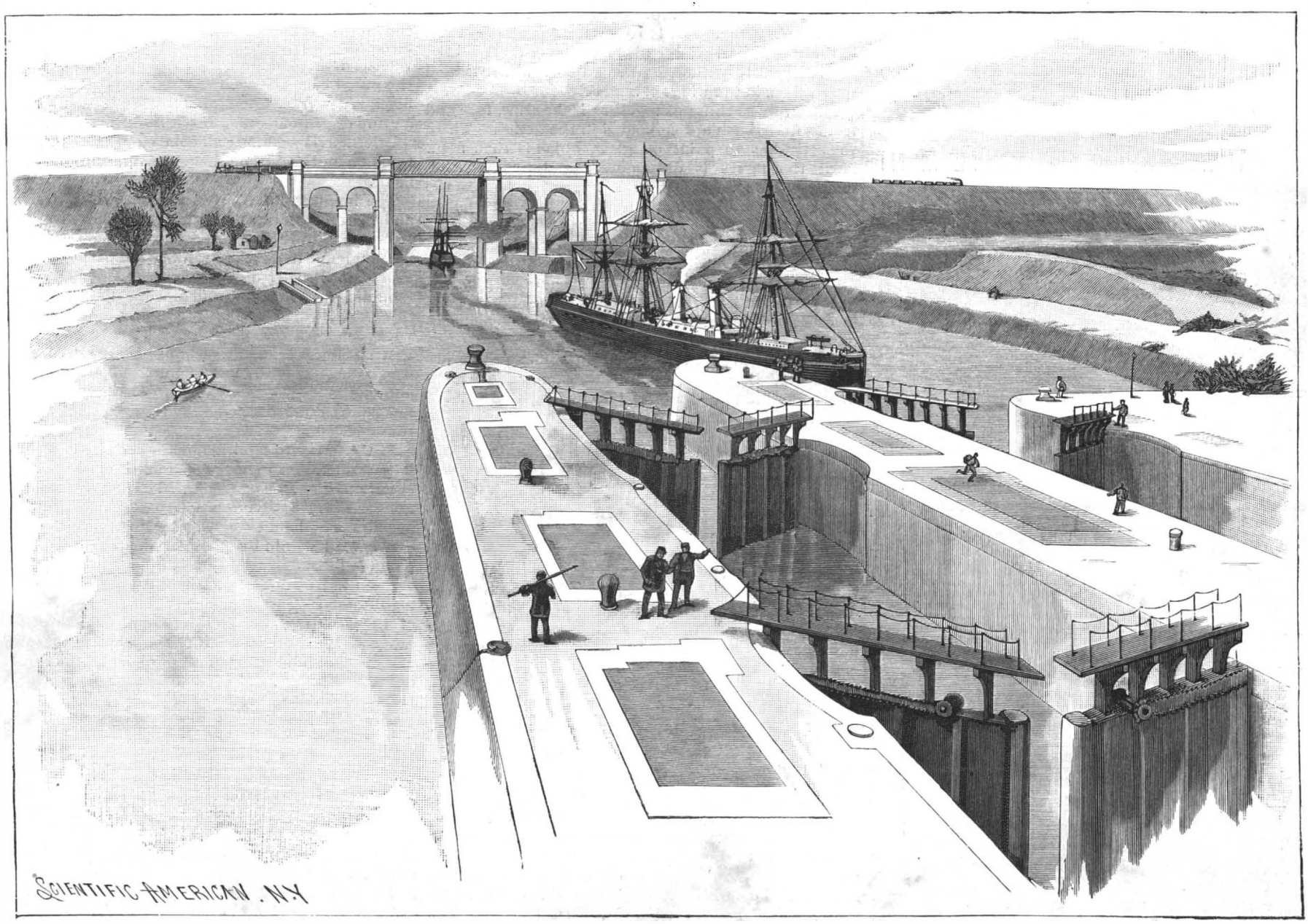
The first turf was cut by Lord Egerton in 1887, and a little less than seven years have been occupied in the construction.

The Manchester ship canal is 35½ miles in length and will have a minimum depth of 26 feet. The minimum width at the bottom is 120 feet, and the average width at water level is 172 feet, so that two large vessels could easily pass each other on the way. All bridges that are not swing bridges have a clear headway of 75 feet, so that the largest vessels may easily pass up and down. The canal emerges from the Mersey estuary at Eastham, and in its course to Manchester rises 71½ feet. To accomplish this there are five sets of locks. (Our illustrations, we should mention, are from photographs by Mr. H. Garside, of Manchester.) As far as Runcorn the canal skirts the estuary of the Mersey, a distance of about fifteen miles in a direct line; thence it strikes inland and the nature of the work becomes more that of canal engineering proper, while in the lower reach it more resembles harbor work, consisting largely of sea wall.

(*Continued on page 152.*)



THE MANCHESTER SHIP CANAL—THE NEW DOCKS AT MANCHESTER.



THE MANCHESTER SHIP CANAL—THE LOCKS AND RAILWAY VIADUCT AT IRLAM.

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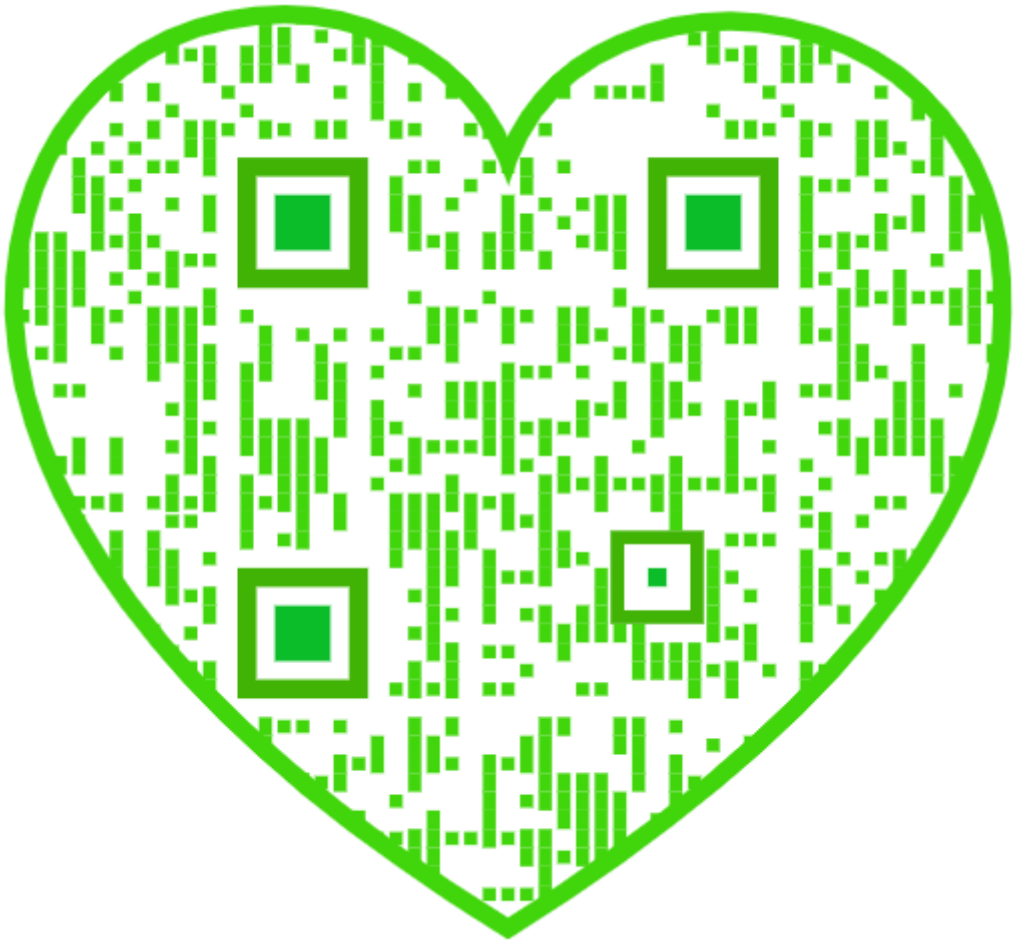

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THE TIFFANY GLASS EXHIBIT.

During the last few weeks an exhibition of colored glass work has been open to the public which has admirably illustrated what may be fairly termed a typical American industry. The Tiffany Glass Company have installed in their rooms in this city the leading articles of their Chicago exhibit. These comprise, as the main element, perhaps, the beautiful colored windows, although the use of glass mosaic in the way of pavements and screens, and in altar construction, was equally interesting.

In the old time methods colored glass windows were made from flat colored glass. This is cut into pieces of proper contour according to the design to be reproduced, and is then put together with lead strips. These strips are H-shaped in cross section, the glass panes entering the grooves. The strips after introduction of the glass, around which pieces they are closely bent, are soldered together at their intersections. Thus a design is produced all in flat transparent pieces, which are naturally of the most varied sizes and shapes. The design is traversed in every direction by the lines of lead, which have become one of the typical features of the objects.

In the Tiffany windows a most interesting departure from this is effected—the use of thick wrinkled glass is adopted to the greatest possible extent, and windows which as art objects fairly compare with the finest oil paintings are produced. Some notes of the mechanical process followed may be of interest.

From the factory of the firm glass sheets of various colors, opaline, enamel white, and of every conceivable tint, are received. This comes in irregular pieces, two or three feet in diameter, and has its upper surface deeply wrinkled. It is as if one poured out lead upon a marble slab and then trickled more lead upon the surface of the congealed mass. The different colors of glass have each their number.

A design for a window as handed to the workman tells him what colors to use. He attacks his stock of glass, picking out therefrom a piece of suitable color. This is not all; the wrinkles must accord with the design. Thus if the dress of a female figure is to be reproduced, one piece of glass after another must be examined until a proper lay of wrinkling is found. The portion of the glass suitable for the purpose may be in the center of a comparatively large piece. With a glazier's diamond the piece to be selected is scored around, and with a pair of pliers the workman breaks away the rest bit by bit, until he has left the desired part. The glass is so rough and strong that a clean diamond cut cannot be made. In this way the pieces are secured. The figure is built up by cementing these pieces against a sheet of glass, leaving space enough between the edges to represent the place for the lead strip. The care devoted to the wrinkled glass is shown in a white enamel glass, which is thrown into long rows of transversely wrinkled corrugations, which is used for feathers in the wings of angels.

The figure as thus put together lacks arms, face and feet as far as such are embodied in the design. These the artist has to paint on glass, which is then fired. Next the figure is dismounted, and put together finally with lead strips, and a superb effect is the result. The work of artist and mechanic has joined hands in the fullest sense of the term.

Besides windows, glass is applied to the production of other objects. The altar and accessories exhibited under the title of "The Chapel" exemplified the perfection to which iridescent glass mosaic has been brought. The altar, except for its marble slab or ledge, the pavement and steps leading to it, the pulpit, and even the bodies of the candles, are of glass mosaic. It is calculated that one hundred and fifty thousand pieces entered into its construction. Incidentally, the setting of topazes in the cross, each topaz on a spring, so as to produce almost perpetual play, may be noted. Stones from the four quarters of the world were symbolically employed on the altar.

An interesting development of glass mosaic is the iridescent effects produced. In excavating in the churches of Ravenna glass mosaics were exhumed which had become iridescent by change of their surface, due to long action of the elements of the soil thereon. The same effect is now produced in the glass house, and some of the beautiful mosaics of the altar are as iridescent as the ancient Ravenna glasses. A peculiar effect was produced in the design of a peacock, also in mosaic. This was really concave, but the result was that of relief—an interesting use in art of an optical illusion.

The Pan-American Telegraph Line.

We learn that a syndicate has been organized for the purpose of constructing a Pan-American telegraph line to extend along the Pacific coast from Victoria, British Columbia, to Santiago, Chile, passing through the United States, Mexico, the Central American States and the Pacific coast countries of South America. This will greatly add to the facilities for communication with the South American States. The great railway is next in order.

Haiti.

The last *Bulletin* of the Bureau of the American Republics, just issued, is devoted to the subject of Haiti, which, along with its sister republic Santo Domingo, covers an island that, for several reasons, is said to be materially and geographically, as well as historically, one of the most remarkable places in this hemisphere.

At whatever point the island is approached from the sea, it looks, when seen from afar, like a huge mass of mountains running in all directions, all jumbled up and seeming to come right down to the water's brink. It was for this reason well named by the aborigines Haiti, which signifies a mountainous country. This island was the sixth point of land discovered in 1492 by Columbus, during his first voyage, and was named by him Hispaniola. He found it peopled by about one million natives, the gradual destruction of whom has been so complete that not a trace of Indian blood is found on the island to-day.

Everywhere on the coast are bays and inlets, many of which afford safe anchorage for vessels. There are no less than eleven ports open to foreign commerce on the Haitian side of the island; three or four others where foreign vessels are allowed to take cargoes, but not to clear for the high sea; and a large number of smaller ports open only to the coasting trade. There are three rivers, properly so called, and forty three rivulets. In the interior there are some quite large lakes, the waters of which are often very deep. There are several great plains in Haiti, all remarkable for their fertility and productiveness.

The climate is wholly tropical, and, to some temperaments, the blazing sun and the unceasing heat are well nigh intolerable.

The most common ailments are fevers, almost all of a bilious type, well understood and not regarded as serious or dangerous. Yellow fever, which is considered infectious, but not contagious, is exotic in Haiti. All fevers of the typhoid type are very rare, and pulmonary disease is almost unknown. Acute dysentery and other bowel troubles are very rare, and so are Bright's disease and other kidney troubles.

Mining interests have hitherto been wholly neglected in Haiti, and her resources in this respect are kept in the background and seldom referred to. Nevertheless, it is well established that gold, platinum, silver, copper, iron, tin, manganese, antimony, sulphur, rock salt, bitumen, etc., exist. Some of them probably in quantities that would make the production of them remunerative.

The present population of Haiti is estimated to be somewhat more than a million. Less than one-tenth of the population consists of white foreigners, mulattoes, quadroons and octoroons, the remaining nine-tenths being what, in the United States, would be called persons of unmixed African blood, though they have names out there to designate and define the various degrees of admixture from the mulatto toward the pure black Thus, the child of a mulatto and a black is a "griffe" (feminine "griffona"), the child of a griffe or griffona and a black is a "marabou."

Intermarriage among all colors and races in Haiti is common and excites neither special attention nor comment.

The language of Haiti is French, which is spoken and written in all its purity by the educated classes.

The peasants speak only what is called the creole, which almost deserves to rank as a separate language, though it is really only a dialect. Everybody in the republic, the educated and uneducated alike, speaks this creole, which is absolutely necessary in dealing with the country people. It is essentially an unwritten language, and its leading characteristic is abbreviation. For any intelligent foreigner desiring it, and on the spot, it is easy to acquire, a residence of a few months sufficing generally for a fair beginning to that end.

In Haiti, the recognition of the principle of full religious toleration was contemporaneous with the Declaration of Independence. The government has given and is still giving proof that it stands ready to encourage and aid every legitimate effort to establish and spread within its jurisdiction the Christian religion of all recognized denominations.

From the beginning, the government of Haiti has manifested a commendable concern for the education of the youth of the country, and, to that end, has never ceased to encourage the establishment of primary schools and institutions of higher grade throughout the republic. It gives encouragement to all of them and aid to nearly all. Hundreds of Haitian youth of both sexes are abroad every year to complete their general education or to pursue special studies. In many instances, the government comes to the rescue of parents whose means are not adequate to bear the expense of sending their children abroad.

Haiti formally became a member of the Universal Postal Union in 1880. She is, however, in touch with the outside world by means of the submarine telegraph, which was completed and open for operation at Port au Prince December 30, 1890.

Aside from the large number of foreign sailing vessels which visit her ports, there are several lines of

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steamers running upon regular schedule time between her principal ports and New York, Europe, Venezuela, Colombia and some of the ports of Central America, Mexico and the islands of the Antilles. From this, it will be seen that Haiti has no lack of the ordinary means of communication with the rest of the world, and, though she has as yet no railways in operation, all her inland towns will soon be put within quick reach of one another by inland telegraph lines now constructing to traverse her interior.

A full list of the articles of export is as follows: Coffee, cacao, cotton, logwood, mahogany, bois jaune, lignumvitæ, bayarondes, hides, raw and tanned, including goat skins, sugar, honey, rum, wax, gum guiacum, peppers, tamarinds, orange peel, sea shells and old copper.

If sugar and rum be excepted, scarcely any others of the articles in the above list require for their preparation the use of machinery, so that Haiti may at present be ranked as almost wholly an agricultural country.

In regard to Haiti's importations, there do not appear to be, in any accessible form, details which will show in full the kind and the quantities of the articles imported.

Natural History Notes.

Gigantic Leaves.—What trees bear the largest leaves? An English botanist tells us that it is those that belong to the palm family. First must be mentioned the Inaja palm, of the banks of the Amazons, the leaves of which are no less than 50 feet in length by 10 to 12 in width. Certain leaves of the Ceylon palm attain a length of 20 feet and the remarkable width of 16. The natives use them for making tents. Afterward comes the cocoanut palm, the usual length of whose leaves is about 30 feet. The umbrella magnolia, of Ceylon, bears leaves that are so large that a single one may sometimes serve as a shelter for 15 or 20 persons. One of these leaves carried to England as a specimen was nearly 36 feet in width. The plant whose leaves attain the greatest dimensions in our temperate climate is the *Victoria regia.* A specimen of this truly magnificent plant exists in the garden of the Royal Botanical Society of Edinburgh. Its leaf, which is about seven feet in diameter, is capable of supporting a weight of 395 pounds.

The Adaptation of Batrachians to Habitat.—Mr. Dissart has been making some researches upon the physiological problem presented by the double habitat of batrachians. Starting from the fact of observation that certain of them have a predilection for a certain medium, for example, the triton for water, the salamander for air, and the frog now for air and now for water, according to atmospheric conditions, and that, on another hand, morphology demonstrates that these three types of batrachians descend from a common stock akin to the group of the crossopterygian ganoids, Mr. Dissart has thought that the explanation of this curious phenomenon of adaptation must be demanded from embryological physiology, called by him physiogenesis.

He is confining himself at present to a study of the role of the functions that he believes to be preponderant in the determination of the evolution, viz., respiration and transpiration. He has found that the aquatic species transpire more than the terrestrial ones, and that the contrary is the case with regard to respiration.

It is this antagonism that, according to him, determines the habitat. In fact, if we place an aquatic species in an aerial medium, its transpiration increases, and, in order to resist such increase, it returns to the water. If, on the contrary, an aerial species is kept in an aquatic medium, its respiration diminishes, and, in order to obviate such diminution, which causes asphyxia, it is necessary for it to return to the air.

Changes of Plumage in the Bobolink.—Mr. F. W. Chapman shows in the *Auk*, November, 1893, a colored plate illustrating the change of plumage in *Dolichonyx oryzivorus.* According to the author, the male bobolink in the course of one year passes through the following phases of plumages: Late in July, when the breeding season is over, the black male undergoes a complete moult and appears in the yellowish plumage of the reed bird, which closely resembles the plumage of the breeding female. In this costume the birds migrate southward, pausing in the rice fields of our Southern States, and apparently continuing their journey to the Campo districts of Brazil. A specimen taken at Corumba, Matto Grosso, Brazil, shows that in the spring, as well as after the breeding season, a complete moult takes place, and the male appears in a suit of black feathers tipped with yellow. As the birds travel southward, the yellow tips slowly drop off, the nape, scapula, and rump fade, and the bill and feet change respectively from flesh color to blue-black and brownish-black. This is shown in a finely graduated series of intermediates in the American Museum, of New York. Birds taken during the summer represent the extreme of faded and abraded plumage.

Commensal Fishes.—Very recently, Professor Leon Vaillant, through the intermedium of Mr. Emile Blanchard, communicated some very curious data to the Academy of Sciences in regard to a new species of fish recently discovered, akin to the genus *Fierasfer*, and which he has named *Rhizoiketicus Carolinensis.* This fish presents some peculiarities of life that are truly very curious. Like the various species of *Fierasfer*, in fact, the *Rhizoiketicus* lives regularly in free commensalism with various marine animals, and especially with certain holothurians. There is nothing curious, however, as to this association of the fish with its host. Professor P. J. Van Beneden, in his interesting work on commensals and parasites, relates in a charming manner the story of this not to be suspected assemblage of two beings: "An interesting commensal of this first category of free commensals," says he, "is a fish of a graceful form called the donzalle, which goes to seek its fortune in the body of a holothurian. Naturalists have known it for a long time under the name of *Fierasfer.* It has an elongated body similar to that of an eel, all covered with scales, and, as it is much compressed, it has been compared to the sword that jugglers thrust down their œsophagus. It is found in different seas, wherein it exhibits the same habits. It dwells in the digestive tube of its companion, and, without any regard to the hospitality that it receives, helps itself first to its part of everything that enters. The *Fierasfer* has found a means of having itself served by a neighbor better equipped than itself for fishing."

Nothing is more ingenious than the process employed by the commensal fish for introducing itself into its host. Profiting by the instant at which the holothurian dilates its mouth, it quickly introduces its tail as far as possible. The surprised holothurian, upon feeling the unknown body penetrating it, contracts its open mouth, and the *Fierasfer* is caught by the tail. Thus held, it takes care not to stir. Soon, however, regaining its confidence, the holothurian opens its mouth again and the *Fierasfer* profits by it to penetrate a little further into the anterior cavity of the animal. After repeating this maneuver once or twice it has soon entered its selected domicile, where it seizes upon all the animal food particles that the holothurian, which is essentially herbivorous, rejects. The mechanism of this association is, as may be seen, truly very strange.

The Sense of Smell in Animals.—Taste and smell are closely allied in man, while in the lower forms of life, especially the aquatic, the organs cannot be differentiated, though there is no doubt of the existence of the sense of smell. The organs of smell in the higher animals protect the respiratory tract. The current of air needed for respiration also conveys odoriferous particles to the nose. The nasal membrane contains the olfactory cells, from which a delicate filament passes to the surface, ending, in birds, reptiles, and other lower vertebrates, in a fine hair or group of hairs. In insects the organ of smell has not been certainly located, but it is now almost certain that it is in the feelers or antennæ. Carrier flies deprived of these organs cannot find putrid flesh.

These slender, hair-like antennæ are organs of wonderful structure; they contain thousands of minute pits and cones—often filled with liquid—each of which forms a termination to a different nerve with its special sensory rod or hair. Wasps and bees have about twenty thousand of these pits or cones in their antennæ, so that it is possible for these organs, small as they are, to contain the nerve terminations, not only of the organ of smell, but of hearing and touch also. It is probably by the sense of smell that bees and ants distinguish between friends and strangers. Ants have doubtless other means of testing identity. With four hundred thousand in a nest, a stranger is at once recognized. Even when pupæ have been taken from the nest and the ants restored they have been recognized as belonging to the hive.

The keenness of the sense of smell in animals is one of their chief means of protection. With many it gives warning of the approach of danger, while some, like the skunk, emit an offensive odor as a means of defense. Smell also forms one of the chief means by which animals recognize their friends. The organ is very large in all carnivorous animals. In seals it is so large and protuberant that it almost blocks up the entry of the respiratory organs.

The vulture's olfactory nerve is five times as large as a turkey's, but it is doubtful if its sense of smell is as strong as has been supposed. Mr. A. R. Wallace's experiments on this point with South American vultures showed that they could not find carrion if wrapped in paper or concealed by the grass. The sense, however, appears to be very highly developed in the apteryx, which has the largest olfactory nerve of any bird probably, even finding worms underground by means of smell. Birds cannot dilate their nostrils, which are in fact only minute apertures. Pelicans have no external nostrils. Scents reach their organ of smell by the palate.

The cetaceans, excepting the whalebone varieties, have no olfactory organ, and, therefore, no sense of smell. The external orifices in seals, water snakes, crocodiles, etc., can be closed by means of a valve. Fish, mollusks and crustaceans are all supposed to possess the sense of smell in greater or less degree. The actual cause of smell is still in dispute. Prof. Ramsey has lately propounded the theory that smells are caused by molecular vibrations lower than those which give rise to heat or light. The olfactory surface to be sensitive must be moist; a moist atmosphere renders scent more perceptible.—*Chambers's Journal.*

A Journey Across Iceland.

At a recent meeting of the Royal Geographical Society, Dr. Karl Grossmann read a paper narrating his journey across Iceland. The journey was undertaken by him in company with Dr. Cahnheim in 1892. They arrived at Reykjavik on June 14. A striking feature to the traveler throughout the journey was the occurrence of low grass hillocks studding almost every part where vegetation was fairly abundant. These had probably originated by the formation of conical sand heaps, which owed their shape to the melting of snow on a loose soil. A few hours' ride took them to the Gullfoss, probably the fullest of the many Icelandic waterfalls, which in two fine cascades fell into a deep chasm with walls of basalt. The state of the country compelled them to return to Thingvellir and to strike northward from there, crossing the inhospitable pass called Kaldidalur (Cold Vale), where a truly Arctic snowstorm prevented them from seeing the beautiful snow cupolas of the surrounding mountains. From Kalmanstunga a short ride brought them to the lava cavern Surtshellir. They explored this cavern and photographed by means of magnesium light the wonderful ice cave which existed in its furthest recess. On their return journey they made a second descent with the view of searching for the coins deposited there by previous travelers. Successful in their efforts, they took two of the oldest coins (these were exhibited), after leaving new ones in their places. It was their intention to restore the old coins to their old resting place at the occasion of their next visit. From Kalmanstunga they had to turn to the west, into the Reykjadalr, full of hot springs. At Reykholt one of these springs had been utilized for a large open air bath, used nearly 700 years ago by Iceland's greatest son, Snorri Sturluson, the poet of the younger Edda. Turning northward they found a great difficulty in fording the river Hvita, swollen at that time to very unusual dimensions. Coming through the desolate Holtavorthuheithi they reached the Hrutafjorthur, an inlet of the Polar Sea, and found on its shores a great amount of driftwood cast up by the north winds. Of the greatest interest were the hills of Hnausar, the Vatnsdalsholar, which had been described as the product of an earthquake. As a matter of fact they were exquisite examples of moraine hills and were legacies of the glacial period. Similar hills were found near Vithimyri, in the Oexnadalr and in the valley of the Northern Laxa. After fording the vast expanse of the river Herathsvatn, where several seals were observed, they reached finally the second town of the country, Akureyri, a flourishing settlement, famous for the biggest trees of the island, a few small mountain ashes. The long estuary of the fjord had to be crossed on horseback to reach the eastern shore, a steep incline about 2,000 feet high. From the crest of this ridge a panoramic view was obtained of the river delta, the snow-covered mountains above Akureyri, and the Arctic Sea to the north. Past the Gothafoss they reached the farm and parsonage, Grenjatharstathir, where they found the only Runic inscriptions on some basaltic columns used as tombstones. Northward they passed the Uxahoer (Ox Spring) geysers, very similar to the better known ones in the south. A long ride through dwarf "forest" and over lava desert brought them to the remarkable rift Asbyrgi. On the following day they were favored with bright sunshine, enabling them to take good views of the remarkable craters called Hljothaklettar (echo rocks). Only five hours distant from there was the imposing Dettifoss, Iceland's and Europe's highest waterfall, formed by the Jokulsa, which leaped with one bound into a rift over 300 feet deep. On their way to the Myvatn (Midge Lake), through a desolate desert of volcanic dust, they passed the steaming sulphur mountains and the spluttering mud caldrons. The Obsidian Mountain, near the Krafla, formed the object of a special excursion from Reykjahlith on the Myvatn. Also Hverfjall, an enormous crater of great beauty of form, was explored. On their return they were compelled to traverse almost the same route. Wherever they entered a farm they were received with the greatest hospitality, and had thereby plentiful opportunities of studying the adverse conditions under which the people lived, and which were most unfavorable as far as hygiene is concerned. This was hardly to be wondered at in a country where fresh food was scarce, the climate extremely severe, and communication difficult. These conditions combined to produce much suffering, and their advice as medical men was often in request, especially on their return to Akureyri, where they were compelled to hold a regular "clinique" to more than fifty patients, some of whom had come from a considerable distance.

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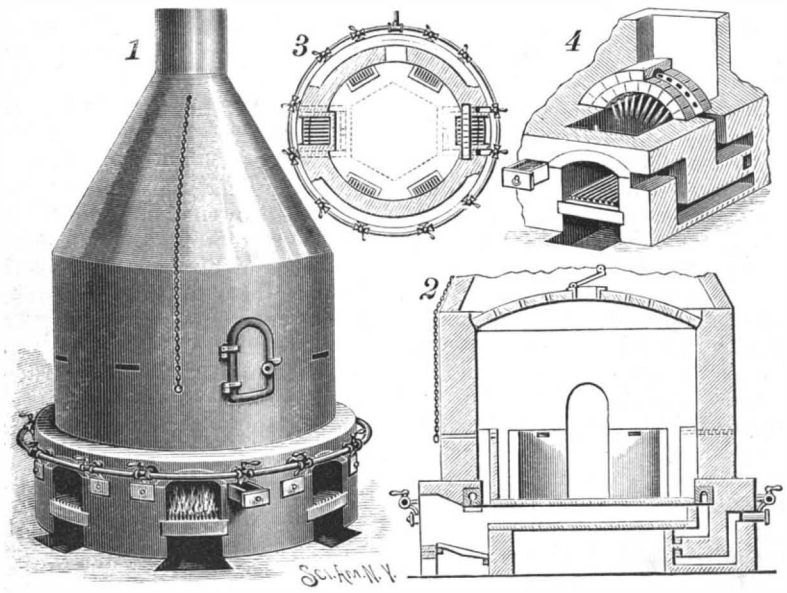
AN IMPROVED POTTERY KILN.

This kiln is designed not only to save fuel and preserve the brick, but also to afford heat better adapted for pottery ware than can be obtained with the ordinary construction, reducing the losses from cracked ware and eliminating crazing or crackling. It has been patented by Mr. John Hawthorn, of No. 554 Perry Street, Trenton, N. J. Fig. 1 is a view of the kiln in perspective, Figs. 2 and 3 representing it in



HAWTHORN'S POTTERY KILN.

vertical section and plan, and Fig. 4 illustrating the arrangement of one of the fire boxes, showing one of its side flues to convey steam to form hydrocarbon gas at the rear of the fire box. From the rear ends of each fire box a flue leads in the usual way to the baking chamber, which also has a hollow floor connecting with fire boxes. The top of this chamber, as shown in Fig. 2, has perforations through which a portion of the smoke may pass, the main central smoke outlet being controlled by a damper from which a chain extends upward and hangs down within reach on the outside. On each side of every fire box is a horizontal opening to a zigzag flue in the wall of the furnace, each flue terminating at its inner end in the hollow bridge wall, where there are numerous jet openings into the rear end of the fire box. In the mouth of each horizontal opening is a removable pan or drawer in which water is placed to generate steam, the water being preferably supplied through a pipe encircling the furnace, and the cocks being so adjusted that the supply will continuously compensate for the evaporation. The side openings also admit air, which, with the steam generated in the pans, becomes highly heated in passing through the flues to the bridge walls, where the steam and air are ejected in jets into the rear end of the fire box, mingling with the gases of the coal at points near the flues leading to the baking ovens. The combined action of the steam and air thus supplied to the fire is calculated to effect a great saving of fuel, while the hydrogen combined with the carbon of the coal produces a heat designed to act mildly on the pottery, thoroughly baking it, but leaving it perfectly smooth. The kiln is provided with the usual sight holes, so that the interior of the baking chamber may be observed as the baking proceeds.

PLAYING cards were first printed about 1350. It is estimated that the present annual output exceeds 7,000,000 a year.

The Romantic and Practical Use of the Phonograph.

The distinguished vocalist Mlle. Calve, it appears, has become quite expert in the use of the phonograph. Here is what a reporter of the New York *Sun* says:

When Mlle. Calve was driven to the station yesterday afternoon to take the train for Boston a large box accompanied her, inside of which was packed carefully her beloved phonograph. Never were there more inseparable companions than Mlle. Calve and her phonograph. Two hours of each day she devotes entirely to it. On Sundays, as soon as the French mail arrives, Calve shuts herself up in her room with her phonograph for nearly an entire day. The explanation is simple enough. Mlle. Calve is engaged to be married to Henri Cain, the Parisian painter. To a woman of her temperament letters are not only a bore, but positively aggravating. So when Calve left Paris, she and young Cain vowed to each other solemnly they would talk to each other for at least one hour each day. Every Friday night while Mlle. Calve has been here a box containing the phonograph strips which she had used during the week was dispatched to Paris. Next day, when the French ship got in, a similar box arrived from M. Cain. Every little detail of her daily life, the news of each of her operatic triumphs, even her very songs, were poured by Mlle. Calve into the sympathetic ear of her phonograph. Recently, in speaking of her experiment, Mlle. Calve said:

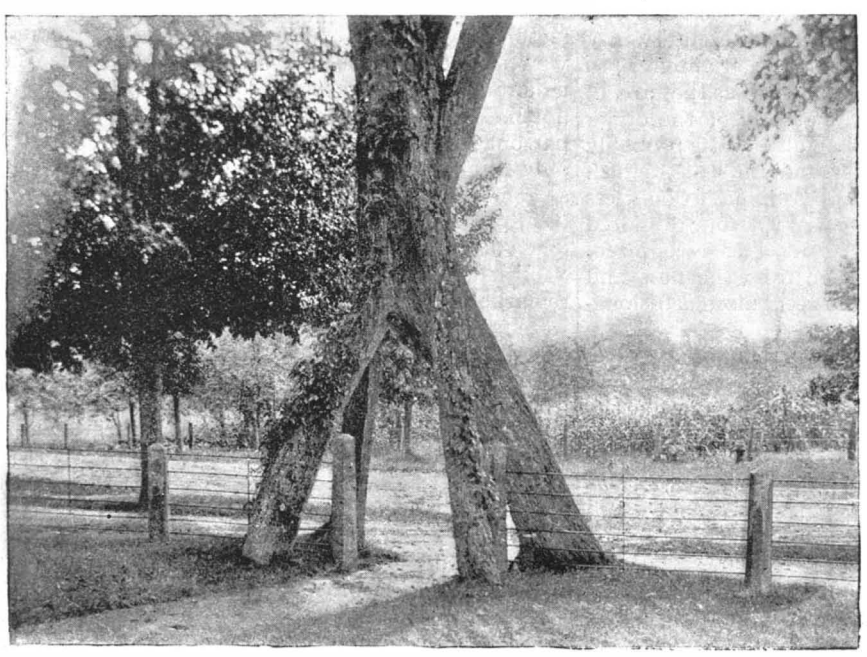
"I would advise all long distance lovers to follow my example. It's such a comfort to hear the sound of your dear one's voice."

"Nothing to be Learned from Americans."

Mr. William H. Preece, of London, in a recent paper, describing his visit to the United States, refers to his former visit in 1877, stating that the results were the introduction in England "of the telephone, the practical application of quadruplex working, the adoption of sound reading in our telegraph offices, the disappearance of the Morse recorder and the more general assimilation of the methods of working in the two countries;" the chief result of his second trip, in 1884, "was the introduction of the multiplex system of working by Mr. Delany, now so much in use among us, and doing splendid service in many of our chief towns." Anything else? Yet some Englishmen claim, adds *The Electrical World*, that there is "nothing to be learned from Americans"!

A NATURAL TREE GRAFT.

We are indebted to Mr. B. B. Keyes, of Boston, Mass., for the photograph from which our engraving of this remarkable tree growth was made. The tree stands at the entrance to a residence on the road near Middleboro, Mass.



A NATURAL TREE GRAFT.

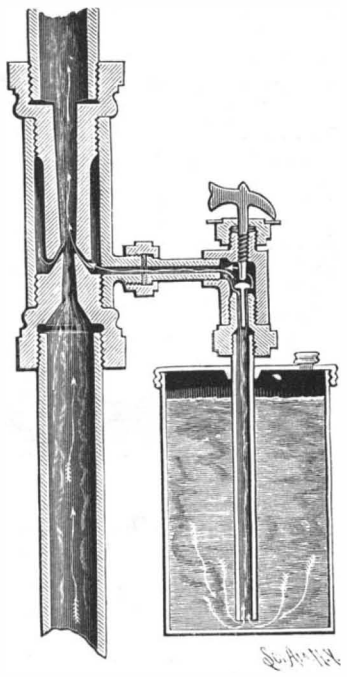
One opinion is that the trunk of the tree separates into several parts at the ground, the parts rising separately about 12 feet and then unite into one body, forming a sylvan archway, through which the path leads. Another theory is that there are separate trees which have become grafted together at the head of the arch. Whichever explanation is correct, the aspect of the tree is very curious, and it has long been a notable object.

Magnesia Furnace Linings.

Magnesia is claimed to be capable of standing far higher temperatures than other kinds of brick, the principal difficulty in using it being the excessive shrinkage to which it is liable when heated—a cube of magnesia of ten-inch edge, in the raw state, is said to shrink to one of six-inch edge, when sufficiently calcined—and, such being the case, furnace linings made of this material are liable to crack badly; as a remedy for this state of things, the magnesia is caused to undergo its maximum possible contraction before being placed in the furnace, though for this an excessively high temperature is required. M. Lencauchez claims to have overcome these difficulties, and has exhibited a number of perfectly solid bricks of magnesia, which were as dense as granite, and had been thoroughly shrunk. The composition of these bricks is 96·25 to 93·25 magnesia, 1·50 to 3·00 lime, 0·75 to 1·25 alumina and iron oxide, 1·50 to 2·50 silica.

A DISINFECTANT MIXING APPARATUS.

This improvement, patented by Mr. Benjamin C. Graves, of Mount Vernon, N. Y., provides means for automatically mixing a disinfectant with a stream of water flowing through a pipe, hose, hydrant, etc., under pressure. In the hose or pipe is arranged an ejector with a tapering nozzle, and connected with a pipe carrying a regulating valve, the latter pipe being extended into a receptacle containing the disinfectant. The arrows indicate the direction of flow of water and the disinfectant in the mixing operation. The regulating valve has a limiting stop, whereby greater or less quantities of the disinfectant may be allowed to pass to the ejector, the stop having a pointer indicating on a dial, to facilitate exact adjustment. The ejector is preferably made with a cone-shaped nozzle fitting into a similarly shaped mouth of a pipe connected by a shell with the nozzle and forming a side chamber, although a different form of ejector is provided for, if desired. The flowing of the water under pressure through the hose or pipe creates a suction which automatically draws in the disinfectant, insecticide or other substance, in measured quantities, according to the adjustment of the regulating valve, in such manner as to insure a thorough mixing. Further information relative to this improvement may be obtained of Josiah Smith, Nos. 175 and 177 North Tenth Street, Brooklyn, N. Y.

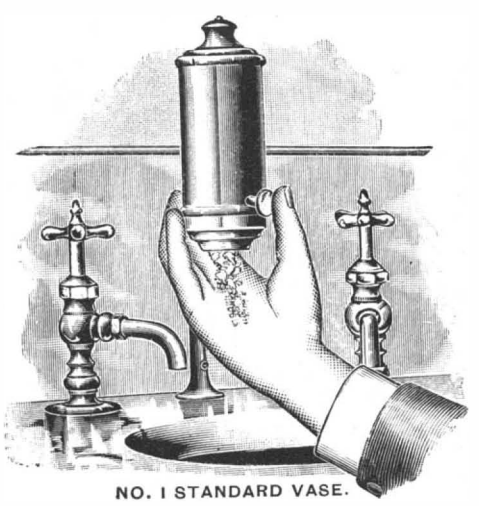


GRAVES' DISINFECTING APPARATUS.

THE SANITARY SOAP VASE.

Instead of using soap for toilet purposes by taking a piece or cake in the hand, and applying in the ordinary way, with water, the device shown in the illustration affords a ready way of using soap, in a manner to be more economical and cleanly, and from which it is styled the "Sanitary" soap vase. It is known that skin diseases are not infrequently propagated by using soap which has been used by others having skin affections—a danger which this device affords effective protection against, while preventing uncleanly appearance of the wash basin, clogging of the waste pipes, etc., there being discharged from the vase, upon pressure of the button, only enough floured soap for one using.

The vase is attached to a suitable standard, to be placed on a washstand or elsewhere, as desired, or it is provided with a bracket, whereby it may be hung on a wall over bathtubs or in other convenient locations. The manufacturer also makes a special floured soap, styled the "Althea," for use in the vase. It is manufactured by W. R. Rannie, Rochester, N. Y.



NO. I STANDARD VASE.

THE Indians of Guiana have a curious system of numeration. They count by the hand and its four fingers. Thus, when they reach five, instead of saying so, they call it a "hand." Six is, therefore, a "hand and first finger;" seven, a "hand and second finger." Ten is "two hands;" but twenty, instead of being "four hands," is a "man." Forty is "two men," and thus they go on by twenties. Forty-six is expressed as "two men, a hand and first finger."

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ELECTRICAL WATER LEVEL INDICATOR.

The apparatus we illustrate has been made by the India Rubber, Guttapercha, and Telegraph Works Company, Limited, for indicating, at a distance, the height of water in wells or tanks, and is described by *Engineering* as follows: Electricity is the agent used in transmitting the records from the tank to the engine house. The apparatus consists of two parts, the transmitter and the recorder. The construction of the former is shown in Figs. 1 and 2. It is placed over the tank, and consists of a framework supporting the shaft, on which is keyed a chain wheel, *b*, over which passes a chain attached to the float in the tank.

Fig. 3.

On the same shaft is a spurwheel, *c*, gearing with a pinion which runs loose on a second shaft above the first. On this shaft is keyed a boss carrying two stops opposite each other, against one or the other of which a pin fixed on the pinion comes in contact, when the main shaft is rotated by the float. It will be seen that either pinion or shaft can thus be moved independently of each other through an angle of about 180°. At one end of the shaft is a crank, connected to the piston rod of the oscillating dashpot, *e*, which insures that all motions of the transmitting apparatus shall be dead beat. Behind this crank is a counterweight, *f*, which is loose on the shaft, but its relative motion to this shaft is limited by a couple of stops, with one or the other of which it comes into contact as the shaft rotates. At the outer end of the shaft is the cam operating the electric contacts, by which the indications of the float are finally transmitted to the engine house. Suppose, for example, the water rises in the tank, then the main shaft is rotated by the float in a definite direction, and likewise the pinion, *d*. This pinion soon comes in contact with one of the stops already mentioned, and then its shaft rotates with it, raising the counterweight. When this counterweight has reached its highest position, any further motion causes it to fall over against its second stop; it then pulls round the shaft with it, this motion being possible because the pinion is not keyed to its shaft. The counterweight comes to rest in its lowest position, but during its fall it has rotated its shaft through an angle of nearly 180°, and in the course of this motion the cams at the outer end of the shaft have made an electric contact, and sent a signal to the engine house. The contact is commenced shortly after the counterweight has begun its descent, and is broken before it reaches its lowest position. The dashpot insures that this contact shall be sufficiently prolonged to insure a sharp and distinct signal being sent to the recorder at the other end of the line.

The transmitting contacts are best seen in Fig. 2, where the connections are also indicated. E and L stand for earth and line respectively, and C and Z for the zinc and copper poles of the battery. The two rods, *g* and *h*, are pressed by springs against a contact piece placed between them, which is permanently connected to the zinc pole. Outside of these rods are the spring contacts, which are permanently connected to the copper element, but in the normal state of affairs the rods stand clear of these contacts. It will be further noted that one of the rods is connected to the line and the other to earth. Between the upper ends of these rods is an ivory pin, fixed in a lever, *k*, which carries at its upper end followers on which the cam acts. When this cam is rotated it gears with *k*, below, and deflecting this, the ivory pin moves one or other of the rods, *g*, *h*, away from the zinc contact, and later on brings it into contact with one of the copper terminals, *i* or *j*, as the case may be. This done, the circuit is complete and the signal sent to the recorder. It should be observed that the first part of the motion, by which one of the rods is raised from the zinc contact, is effected by the small central portion of the cam, while the counterweight already mentioned is being raised; the copper contact, on the other hand, is made by the exterior of the cam as the counterweight completes the revolution of its shaft. The net result of the above operations is that, if the float in the well rises, a current is sent through the line in one direction, and if it falls, in the opposite direction, and the currents are made to work a recorder at the other end of the line, the construction of which we will now describe. The dial which shows the feet and inches is illustrated in Fig. 3, while the details of its construction will be understood from Fig. 4. The apparatus consists essentially of a couple of electromagnets, which work pawls gearing with an escape wheel below them as shown. To perform the requisite motion one pawl only is required per magnet, but the upper pawls serve to lock the wheel when the magnets are not acting. The two magnets are in series with the line, and hence the current passing through both magnets would tend to raise the pawls on each side of the escape wheel, and no motion would accordingly be made. It is necessary, therefore, that the current shall act on one magnet only when a rise is to be recorded, and on the other only when a fall of water level occurs, *i. e.*, according as positive or negative currents are sent into the line. This is accomplished by the polarized relay shown on the left, which actuates a contact, short-circuiting one or the other of the main magnets, as the current passed is positive or negative.

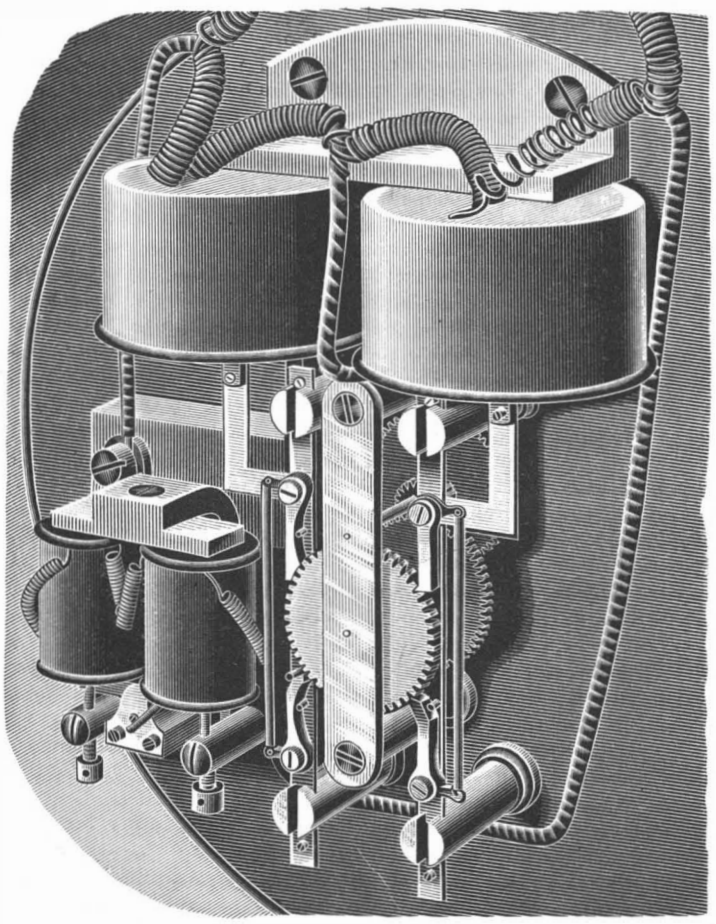
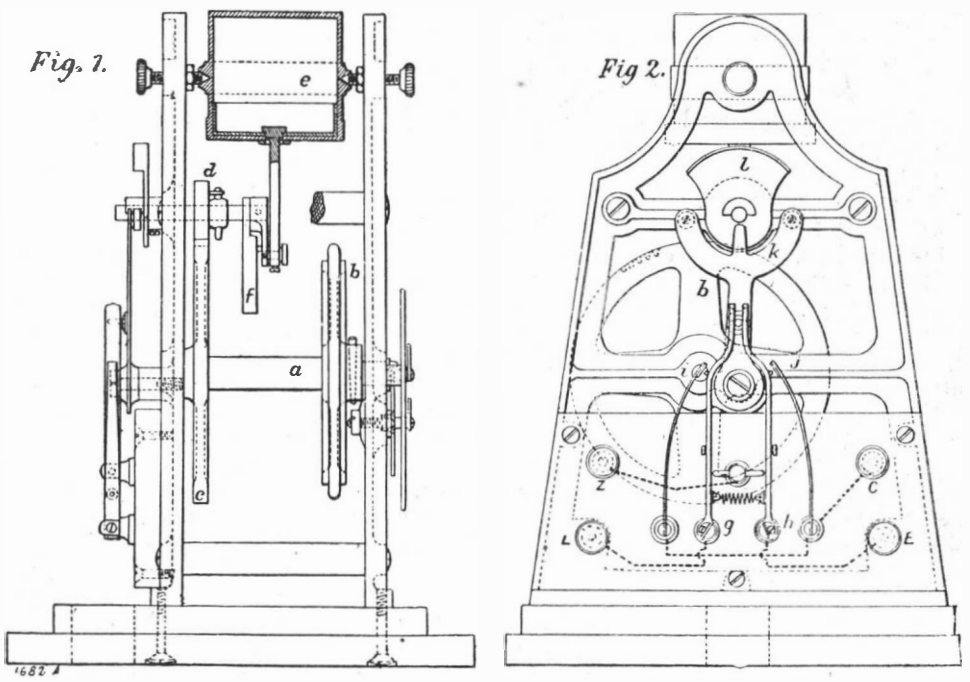


Fig. 4.—ELECTRIC WATER LEVEL INDICATOR.

The recording apparatus illustrated is of the dial type, but the makers also supply an autographic apparatus which records the level by means of a pencil drawing a stepped curve on a cylinder.

THE success of the electric launches on the lagoons of the World's Fair at Chicago was so marked, says the *Electrical Engineer*, that the idea of trying the same boats on the lagoons and canals of Venice at once suggested itself. The result was that one of the launches which had been in service at Jackson Park from the early spring was shipped last September to Venice, her motor and batteries being removed from the hull for the Atlantic voyage. Arrived at destination, the various parts were all reassembled, and under the fitting name of Venezia the little craft made her first appearance in the waters so long monopolized by the song and oar of Adria's gondolier. It is needless to say that she created a sensation, for her quiet and graceful performance, so different from the noisy, fussy movements of the steam launch, gave immediate proof that in the electric boat the time-honored gondolier had at last met a rival against which no halo of poetry and romance would help it greatly. A picture of the Venezia was made recently as she lay in the waters of the Grand Canal right opposite the Doge's Palace. Mr. R. N. Chamberlain, whose intelligent engineering supervision did so much to render the boats a success at the Fair, where they carried 800,000 passengers, proceeded to Venice as soon as he could be spared from Chicago, and had the boat fixed up in good shape. She now has 68 cells in four groups, governed by a mechanical controller. In order to protect her hull against the weeds and action of the canal water, her hull has been sheathed with copper. The success of the boat is indubitable, but we understand that the fleet of which she is the prototype will all be longer, so as to afford greater passenger capacity. Her deck housing is slightly changed, it being now made to conform to the general style of the quaint cabin top seen on the gondolas in Venice.



ELECTRIC WATER LEVEL INDICATOR.

A Fortune for Some One.

This is the heading of a paragraph we find in the *Mail and Express*. The writer had been thinking and concludes that the man who invents something by which the thousands of cubic feet of steam which continuously escapes from the boilers of this and other big cities can be utilized has in his grasp the biggest fortune ever heard of on the American continent. Go up to the top of one of the tall down-town office buildings and look out across the roofs of the city. For block after block and mile after mile can be seen hundreds and thousands of escape valves pouring out volumes of white vapor. Enough steam is lost in New York alone in an hour to run a great manufacturing city for a week. The loss throughout the country in the same way is something stupendous.

Inventive genius has done much for the human race. It has taught mankind to utilize most of the products of nature. Hereafter it must lead to the conservation of natural resources and to the hoarding of natural capabilities. The human race is developing very fast; so fast that it will not be many centuries before everything that can sustain life or add its quota to the comfort of mankind will be enormously valuable. Only by the most skillful husbandry of their resources do the people of the Chinese empire manage to live. The same thing is more or less true of England and on the Continent, and what has been the rule in older countries must have its counterpart in this.

Already forestry commissions, fish commissions, and similar aids to the saving of natural sources have been instituted. That the need of such commissions should already be felt is ominous. Within a few generations such economies will not be expedients; they will be necessities.

AN OREGON DIAMOND.—In October, 1893, a boy picked up, near Oregon, Wis., a small semi-transparent pebble from a bank of clay that contained a large number of quartz pebbles. The stone was taken to Professor William H. Hobbs, of the University of Wisconsin, at Madison, and it was found to be a genuine diamond. It proved to be an elongated dodecahedral crystal, weighing 3⅞ carats. Its color is slightly grayish green. This, however, is only superficial, and it will undoubtedly cut a white stone, although not of great value.

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Longevity.

At a recent meeting of the New York Academy of Medicine, Charles E. Quimby, M.D., chairman, the subject for discussion was the "Specific and Relative Value of the Important Factors of Longevity."

In arranging the discussion on this subject, the chairman had requested examiners for several of the life insurance companies as well as others to take part. He first called upon Dr. E. W. Lambert, who said he responded to the invitation with some diffidence, because he found the subject so complex, the factors so many and apparently contradictory. Of course, in his long experience as examiner for life insurance, the question of longevity had naturally presented itself. In spite of the long time this question had been before him, he could not say that it had particularly cleared up: it was still debatable as to what were absolutely important and also relatively important factors of longevity in individual cases. In the first place, however, we must exclude two words, viz., always and never.

Long-lived Ancestry.—The first important factor, it seemed to him, was that the man should have a good inheritance. No one could deny that long life on the part of ancestry on both sides of the house was an important factor in considering the longevity of the individual. Indeed, he knew of no other single factor of as great importance, yet one might feel staggered at times to meet with a case in which a mixture of the blood of a long-lived couple resulted in a short-lived progeny. This was the exception and due to peculiar combination.

Environment.—The next question of importance was that of environment, or the conditions in which a man was born. A comfortable, well-protected, well-organized household, and sanitary surroundings were pretty sure to carry the child through early life with all its attending accidents.

Temperament.—The next important factor was temperament. It seemed to Dr. Lambert that a placid, calm, philosophical way of looking at things was much more conducive to longevity than the irritable, fretting, fussy, fault-finding way observed in some people. This was well illustrated in the case of animals. In a span of horses going up Fifth Avenue it would be observed often that one horse would go quietly along and do all the pulling, while his mate danced, pranced, and cavorted around, wasting his energy and shortening his life with little good.

Manner of Living.—The next matter of importance, he thought, was the way of living. The man who was careful, considerate, and moderate in the exercise of all his faculties, whether animal or intellectual, was one who would last longer than the man who over-indulged in any one of the numerous things which go to make up life. The men who broke down and died prematurely were usually those who had not lived temperately. It was often said that men worked themselves to death, yet the more he observed people, the more did he become convinced of the correctness of the Western editor's assertion that men do not die of overwork, but rather of what they take between work. He thought it would be found that what killed men was not work, but what they did outside of their work; yet he did not believe in total abstinence in any sense. There was no law, with regard to eating and drinking and manner of living, which could be laid down as applicable to all individuals. Each person must find out the law which applied to himself and obey it. Each person could usually discover what agreed and what disagreed with him, and if longevity was sought after, he would have to avoid the things which evidently disagreed with him and seek the things which did agree with him.

Exceptions.—Dr. Lambert added that he was aware that to what he had said one could bring exceptions by the thousand. Take any one of the factors which had been mentioned, and one could mention men who had lived long without any; for instance, with regard to alcohol, men could be found who had done nothing much but drink all their lives, and yet had lived to a full age; but when one found a man who had drank hard all his life, he could be pretty sure he had done nothing else.

All were subjected to circumstances which they could not altogether control, and at times found themselves compelled to do things which they were advised not to do; and now and then it happened that even then, in the case of the person who seemed to possess all the factors of longevity, death ensued early in life.

Professional Athletes Short-lived.—Dr. Brandreth Symonds said that when he was asked to take part in the discussion he expressed the opinion that the subject was rather a large one, whereupon the chairman had kindly extended him the privilege of nibbling at it here and there. With regard to the effects of athletics upon the expectation of long life, it was notorious that professional athletes were short-lived. In seeking a reason for this he had had opportunity to examine four, and only one of the four showed no abnormality. The others had cardiac hypertrophy, one a little emphysema, one a trace of albumen and sugar in the urine. It was different with amateurs, for they left the field before permanent lesions developed. He had examined eleven good amateurs with reference to the question whether they were desirable subjects to insure, and he had found all but one practically sound. The one who constituted the exception had a narrow chest, thirty inches, and secondary enlargement of the heart as a consequence.

The Influence of Build.—Dr. Oscar H. Rogers thought Dr. Lambert was quite correct in regarding the family history as the most important factor in longevity. In the exceptional cases where longevity in the parents had not been transmitted to the offspring it might, perhaps, be accounted for by moderate extremes in some respects existing in both parents, combining and causing marked extremes in the offspring, The form of body was, he thought, next in importance to family history. A person might not only be too heavy, but his fat might also be accumulated in the abdomen, instead of being evenly distributed.

About Consumption.—Dr. Rogers had once considered the question, what persons might be expected to die of consumption, and on looking through a life insurance list had found that about one-fifth of those dying of consumption gave a family history of that disease. Stated in a different form, about four-fifths of the people who died of consumption in adult life gave no history of this disease in their immediate family. Approximately, seven-tenths of those who had died of consumption were under average weight and build. Very few were of the average weight, and fewer still above it. Gout was of sufficient frequency in England to be considered in the family history by insurance companies, but in this country neither it nor rheumatism was considered of so great importance. After the question of disease in the family and the points previously mentioned, he next laid most stress upon habit. Some persons would train well on five pound dumbbells, others better on ten pound ones, and it was the same with alcohol; one man would be a raving maniac with a single glass of alcoholic drink a day, of which another man might take a half dozen glasses and live to eighty or ninety years. He would, therefore, like to see a little wider latitude given the individual—not every individual—in the use of alcohol.

Dr. Rogers had looked over a list of five thousand deaths, in persons whose lives had been insured, with regard to the cause, and had found that about twenty-five per cent had died of diseases of the lungs, and about ten per cent of these had died of tuberculosis, probably ten per cent of pneumonia, the other five per cent of bronchitis and other affections of the lungs.

Dr. Rogers also said, in passing, that post-graduate instruction in New York and other centers had decidedly raised the standard of rural medical men who made preliminary examinations of those applying for life insurance.

The Mutual Influence of the Different Factors in Longevity.—The chairman asked some questions regarding how far inherited constitution might be modified by environment, the mutual influence of the several factors relating to longevity, and the propriety of considering them in granting life insurance.

In reply Dr. Lambert said he had not gone into details, as it would have required all night. With regard to weight, there were two sources of danger, one in light weight, and a very different one in heavy weight. Light weights, as a rule, developed their diseases before forty, heavy weights after fifty. The rule applied in the selection of recruits for the army was the safest he knew with regard to relative weight and height. One was taking an extra risk in insuring a man who did not weigh two pounds to the inch in height. For instance, if a man measured five feet ten and weighed less than one hundred and forty pounds, his life was an extra risk. Of course there were marked exceptions to this rule. In the same line, if a man's chest did not measure half his height, the risk was great. If both the weight and chest measurement were below the proper proportion compared with the height, the sooner the case was barred out, the better for the insurance company.

His idea with regard to fat men was, that the danger increased in proportion to the size of the belly. He did not regard a stout man as an extra risk if he came of a good family and his flesh was well distributed. But if a man's chest measured 36 and his belly 46 inches, he was more likely to die of fatty degeneration than if the chest measured 38 inches. Such persons usually died of diseases "below the belt." The farther a man was away from the ordinary standard in build, the more critically did he inquire into the family history, his personal habits, whether he took more nourishment than any decent man could burn up, and so on. The difficulty with high living was that a man put nourishment into his stomach faster than his excretory organs could eliminate it. He put into his furnace so much coal that clinkers were sure to form, and he would die of some one of the results of carrying in his blood a lot of stuff which ought to be excreted.

The Danger from Alcohol.—Dr. Lambert thought the danger from alcohol lay less in the alcohol itself than in the fact that the subject was apt to keep his stomach on the grind from morning till night, giving it no time, much less half the time, in which to rest.

Bodily and Head Measurements and other Factors.—Dr. M. Morris continued the discussion with a paper. He had studied the subject of longevity more or less for a good many years, not alone in connection with life insurance, but also as a general practitioner should do. Inherited tendency to longevity was an important factor in treating disease. Persons inheriting short life did not present as good prognosis in disease as those inheriting long life. This was especially true in critical diseases. There was an indefinable something in the human organism, varying in degree and force, termed tenacity of life or natural resistance to disease, by which some persons passed most successfully through serious maladies and injuries, while others without so much natural resistance succumbed. This was every-day experience, especially in surgery. This statement did not, of course, imply that proper treatment had not much to do with the successful result.

In a large proportion of those endowed with tenacity of life the ancestry would also be found long lived. Like in other living organisms, some parts of man's system decayed and perished before others. The vital principle was seen to carry on its active process in one organ and another until each one in turn faded, and the being was unable longer to maintain life. It was not within human ken to describe this vital principle, but by observation it was known that certain conditions would cut it short, yet that it was impossible to prolong it by any means whatever beyond the natural inheritance. Some men were at best endowed with short life, while others, if they obeyed the law, could live a long life.

Is it Possible to Predict the Probable Duration of One's Life?—Having put this question, Dr. Morris said that inherited tendencies, habits of living, occupation, observance of sanitary laws, and residence, all had a direct bearing on the question of probable longevity. Acute diseases, bad habits, excessive indulgences, unfavorable residence, all had a life-shortening influence. In all forms of life we must find some substance in common in which life inhered and upon which life must depend. In plant life there were structures not found in animal life, and in animal life there were substances not found in plant life, but in all forms of life there was a secretory tissue. This was the only substance common to all living things. This also had its lifetime, and when it ceased to exist life became extinct. This secretory tissue was the only kind of substance which was transmitted from the ancestors, and therefore it contained in itself all the ancestral influences which were transmitted. But there were different kinds of secretory tissue and different proportions of each, so that the duration of life was a variable quantity. The different organs of the body were not a unit, but aggregations, and one might die and end the individual's life, while others might have lived on to an advanced age. Yet a short-lived organ might not be essential to general life. A life was always a combination of inherited influences, some one of which might be of a kind to reduce the general inheritance below that of the ancestral stock. Current conditions seldom produced a better result than fairly belonged originally to the individual.

It was not unusual to remark that a person inherited red hair from the mother, or a dark complexion from the father, and so on. Why, then, not inherit the stomach from one parent, the liver from the other, and similarly with other organs? One brother resembled in outward appearance almost entirely the mother, a sister the father; if so without, why not within? A greatgrandfather died of heart disease at seventy-six, a grandfather at seventy-one, a father at sixty-five. A son resembling this father might rightfully infer that he would die still younger of the same disease. But instead of calling it disease, call it the natural life shortened by a weakness in the paternal ancestry. Like caused like.

Can the Constitutional Inheritance or Lifetime of Organs be Discovered by External Appearances?—To this question Dr. Morris answered certainly, in the majority of cases. In the first place, by studying the physiological relations of the organs of the body and their mutual influences; second, by observing the external manifestations; also by family history of longevity. A person whose ancestors were long-lived on both sides would, as a rule, be both healthy and long-lived, and able to endure much hardship and grave maladies. On the other hand, those who inherited short life could not by any prescribed system of living protract their short life inheritance. General average law did not form a basis for estimating individual longevity. Lucas had stated that the average life depended upon locality, hygiene, and civilization. But individual longevity was entirely exempt from these conditions. Everything tended to show that long life was the result of the initial principle of vitality which privileged individuals had received at their birth, and this was so deeply imprinted in their nature as to make itself apparent in every part of their organism. It was not the habit of the man who was excitable and always

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in a hurry which made his life a greater risk than that of a calm, philosophical person; it was rather the inherited quality which led to the difference in behavior and, in the case of the philosophical person, gave long life.

External Indications.—There were certain external indications which would give a fair idea of long and short life. It was not in one trait, but in the entire make-up of the individual who stood before the examiner. There were the color, the motions, the measurements, including size of head, which was one of the most certain indications of long or short life, for in the brain lay the great center of power. A person with a head whose diameter at the thin portion of the temporal bones measured five and a half to six inches was almost sure to give a longevity on the father's side of seventy to ninety years or over. If the head measured in front from the external auditory canal to the naso-frontal suture as much as four and three-fourths or five inches, we might be almost sure of long life on the maternal side. A beard which was darker or redder than the hair indicated inheritance from the paternal side; if it were lighter than the hair, the inheritance was probably from the maternal side. The length of the chest, its proportion to the circumference to the height of the individual, and other measurements, were important.

Emphysema and Starvation.—The chairman, Dr. Quimby, quite agreed with Dr. Morris as to the importance of inheritance, but he had been struck with the powerful influence which habit or conditions of life had in the production of certain diseases. He referred especially to emphysema, which he said he had encountered with startling frequency in the dispensaries, and had come to the conclusion that it was due to bad food or insufficient nourishment among poor people. He had found the emphysematous chest repeatedly in persons only twenty-five years of age, or even younger, who visited dispensaries. In striking contrast with this experience, he had not in ten years examined a musician who had emphysema.—*Medical Record.*

Possibilities of Reparative Surgery.

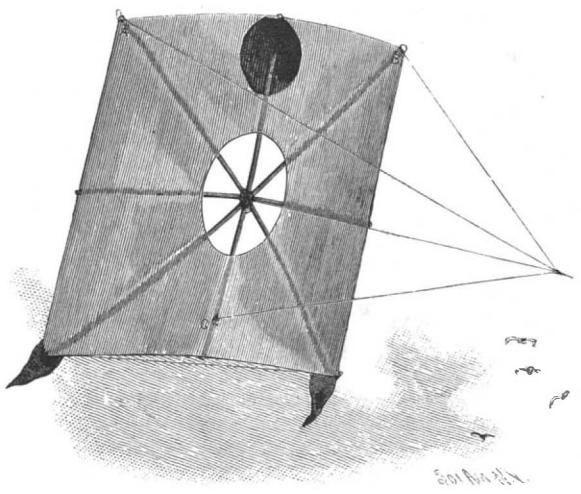
Surgical literature, especially in recent years, contains records of numerous cases in which divided tendons, veins and nerves have been sutured, and in which small members of the body, such as the fingers or the end of the nose, have been successfully reunited. In an article on the surgery of the hand, a liberal abstract of which appears on another page of this journal, Dr. Abbe foreshadows what may become a reality in the future—the restoration of completely severed major parts of the body. The possibility of accomplishing this depends essentially upon our ability to restore the arterial continuity and supply sufficient nourishment to the severed extremity. Experiments in this direction have been made by Dr. Abbe on animals, and the results obtained are of great interest. After cutting across the femorals in a dog he inserted smooth sterilized glass tubes, slightly constricted to an hour-glass shape, tied each end of the vessel over the tube by fine silk thread, and then brought the thread ends together. Primary union took place and the limb was as well nourished as ever; but in order to determine whether this was not due to collateral circulation Dr. Abbe cut out one of the tubes and found the lower end of the vessel occluded by slow endarteritis. To eliminate the element of collateral circulation he tied into the aorta of a cat an inch of very thin glass tube sterilized by boiling and filled with water before inserting to prevent air emboli. This animal also recovered perfectly. A still more radical procedure was then practiced. After dissecting out the brachial artery and vein near the axilla of a dog's forelimb, and holding these apart, he amputated the limb through the shoulder muscles and sawed through the bone, leaving the limb attached only by the vessels. He then sutured the bone with silver wire, the nerves with fine silk, and each muscle by itself, making a separate series of continuous suturing of the fascia lata and skin. Perfect union and restoration of function also took place in this instance. This experiment demonstrates that a limb will survive division of all its structures if an artery be left; and further the author points out that if an arterial supply can be restored to a completely amputated limb, *that* limb also may be grafted back to its original or a corresponding stump. Should Dr. Abbe's investigations—as yet incomplete—show that it is possible to do this in animals, an important contribution will have been made to the subject of reparative surgery. The tissues of animals, however, possess so much higher reparative power than those of human beings, that it is difficult to predict the possibilities of this *fin de siecle* method of grafting.—*International Journal of Surgery.*

Snow Crystals.

Snow crystals are now studied with so much more accuracy from microphotographs than from naked eye observations that physicists and meteorologists no longer depend upon the old method. Prof. G. Hellmann, in his recent valuable work, "Schnee-krystalle," proposes that the crystals be classified as columnar and tabular, subdividing the former class into prisms and pyramids, the latter into stars, plates, and a combination of both.

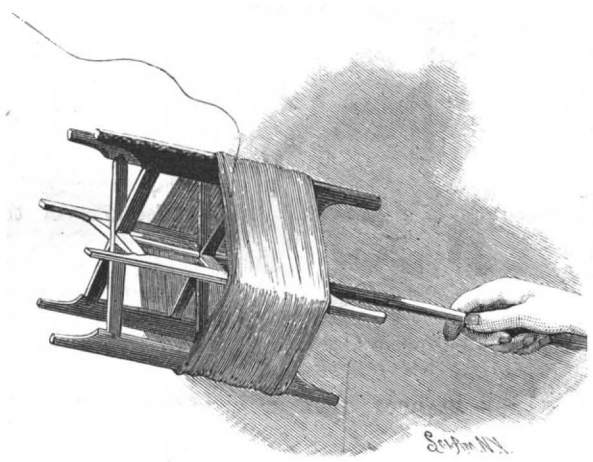
THE COLUMBIAN EXPOSITION—COREAN EXHIBITS.

Corea is a kingdom of Eastern Asia, and its territory is chiefly included in the peninsula lying between the Yellow Sea and the Sea of Japan. The area is about



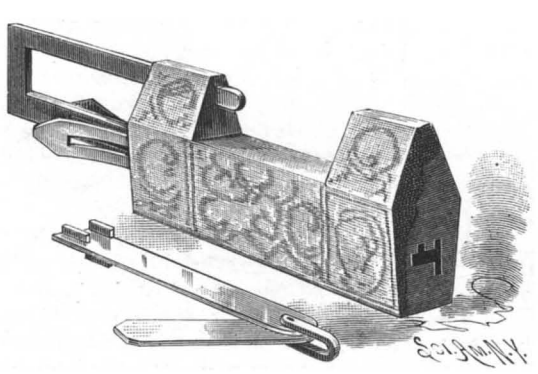
A COREAN KITE.

80,000 square miles, or about two and one-half times the size of Scotland. The population of Corea is estimated at about 12,000,000 and the capital, Seoul, has 250,000 inhabitants. The country is mountainous and is well furnished with rivers. The temperature, though more equable than the surrounding country, is higher in winter and lower in summer than under the same latitudes in Europe. Rice, rye, wheat, millet, tobacco, cotton and hemp are cultivated, but the potato, which was lately introduced into the country, is under a government interdict. Corea is rich in mineral resources,



NOVEL REEL FOR KITE STRING.

but the mines are not properly worked. The King of Corea is a vassal of the Chinese empire, but at the same time is an absolute monarch within his own country. Some of the honors which he receives are very curious. To touch the person of the king with a weapon of iron is high treason, and a king will rather die than submit to any kind of a surgical operation on account of this curious superstition. The language spoken is not Chinese, but belongs to the Turanian family. Education is held in high estimation and the religion is Confucianism. The people live in comfortable tile-roofed houses heated by flues. Though Corea has no railroad as yet, it has electric lights, steamship and telegraph lines.



A CURIOUS COREAN LOCK.

In the history of commerce Corea occupies a curious position, treaties having been only in force since 1882. The exhibit of Corea at Chicago marks a new epoch in the relations of Corea with the rest of the world. It is to be hoped that the insular position of Corea will be modified by contact with other nations, as the people of this strange country have many virtues and excellences hardly to be expected in people of their state of civilization. We illustrate several objects which were exhibited at the Fair. Kite flying is an amusement which is almost universal. The Chinese, Japanese, and Mexicans excel in kite making and flying, and the Coreans are certainly not far behind them. The kite shown in the cut is of moderate size and is made of sticks covered with varnished paper. It will be noticed that at top and bottom the sticks are bent by strings, so that the part of the kite which is exposed to the wind is convex. One peculiarity of the Corean kite is a hole in the center. At the point where the sticks meet in the center the string, which is usually colored, is attached. Three guy lines of equal length steady the kite, and by varying their point of attachment almost any angle can be produced and the kite adapted to all winds. The kites are decorated with paint, the ball being the most common object represented. We also illustrate a reel which is used in kite flying. This reel is about seven inches in diameter and is well made. It turns freely on a pointed stick which is thrust into the ground. Like the Mexicans, the Coreans are very fond of kite fighting. They oil the string near the kite and rub on glass in powder. In a kite battle each person tries to drag his glass-covered string over an unprotected portion of his adversary's string, thus cutting the cord and allowing the kite to blow away.

A curious Corean lock is shown in our third illustration. The lock is after the style of a padlock, and is made of brass. The lock is shown open. The key and the internal mechanism of the lock are very primitive. The two lugs on the upper part of the key press the two springs together and allow the bolt to move. The security of the lock depends upon the springs, which snap into place as soon as they have passed inside, thus forming a V inside the case, in a similar manner as they form a V outside, as shown. Many of the other articles on exhibition showed that the Coreans are handicraftsmen of no mean order, though a lack of proper instruction in regard to mechanical contrivances is shown.

Want of Metric Weights and Measures a Hindrance to Foreign Trade.

In the last published British Foreign Office report (No. 1,300) on the trade, etc., of Bulgaria, it is stated that would-be sellers in England do sometimes go so far as to send out catalogues in French or some other foreign language, but that even then they "persist in retaining the intricate English standards of weights and measures." It is added: The metric system is the one now employed throughout Bulgaria, and it is useless for English manufacturers—especially of machinery and hardware—to expect that their potential foreign customers will give themselves the trouble of learning our avoirdupois and dimension tables in order to be able to puzzle out quarters, pounds and ounces, yards and inches, gallons, pints, etc., into their metric equivalent.

Regarding Peru a correspondent writes complaining of the inconvenience he suffers when consigning machinery. Shipping specifications have to be sent out in metric weights and measures, and if there are any errors, his customers are liable to a fine. This means that he has to make out the specifications twice over, first in English and then in metric weights and measures. He, therefore, urges, and not unreasonably, that the metric system should be adopted officially in England. This would doubtless lead to its being adopted by all shipowners and carriers, and one more step in the direction of an international system of weights would be taken. Great Britain is almost the only civilized country of first rank which is blind to the interests at stake in this question, and it is high time that a public inquiry should be instituted.

Pneumatic Tubes in Chicago.

A pneumatic tube service between the offices of the various newspapers and news associations of Chicago has just been put in operation. Twenty-nine conduits were laid under Clark Street, beginning at Jackson and running north, and branching off at cross streets leading to their respective destinations. These conduits consist of seamless drawn brass tubes 2⅞ inches in diameter, laid in square vitrified clay pipes, surrounded by about 10 inches of Portland cement. In this way all dampness is avoided. In sending the carriers through these tubes only the pressure of the atmosphere will be used, the necessary vacuum in the receiving end being produced by an ejector. The carrier is made of flexible leather, with an inner spiral frame to keep it in shape, and a band of felt around each end to make it comparatively air tight. It is 2¾ inches in diameter and 8 inches long. This system connects the City Press Association and the Western Union Telegraph offices, at Jackson and Clark Streets, with the offices of the different newspapers, national and international news agencies and the central police station. About one minute is required for a carrier to traverse the longest line. Several years ago the principal newspaper offices in this city were connected with the Western Union Telegraph office by pneumatic tubes.

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THE MANCHESTER SHIP CANAL.

(*Continued from first page.*)

Above Warburton the canal absorbs the river altogether, that is to say, it follows the course of the river bed. For a distance of 20 miles beyond Latchford, at which point are situated the first locks above the entrance locks, the canal will be semi-tidal, in order that the "scour" of the tide in the lower part of the Mersey estuary may not be diminished. This is accomplished by openings in the wall dividing the canal from the estuary which admit all tides rising over 14 feet above the Liverpool datum. Just above Eastham locks the canal is broadened sufficiently to allow ships to lie for passing. The small rivers along the estuarial part of the course are carried under the ship canal by inverted siphons, an interesting piece of engineering, into the details of which space forbids us to enter. The river Weaver, which is one of the most important pieces of river navigation in the kingdom, also necessitated some very difficult engineering.

There are five sets of locks on the direct line of the canal, and fine, massive structures they are. Those at Eastham, which may be taken as typical, consist of three locks placed side by side. The largest is 80 feet wide and 600 feet long, the center lock is 50 feet wide and 350 feet between the gates, and the smallest lock is 30 feet wide and 150 feet long. Storm gates protect the lower end of the locks, and prevent the lock gates proper being forced open by water or wind. The lock gates, which in common with the sluices will be worked by hydraulic machinery, are worthy of special notice, as they are remarkable pieces of work. They are made of greenheart timber, clamped and fastened with steel, each leaf containing no less than 180 tons of timber, the steel work bringing the total weight of the leaf to 210 tons. The gates are 5 feet thick in the middle and 45 feet 5 inches high.

The locks are capacious enough for nearly the largest ocean-going steamers, and when the tide rises 14 feet over the old dock sill at Liverpool the water flows in as far as Latchford locks, a distance of twenty-one miles.

The railway diversions are a very important part of the work; indeed, the four viaducts in themselves constitute an engineering enterprise of considerable magnitude, as it is necessary to run a long distance inland with the work to get a gradient when the line has to be raised 75 feet. Where it was impracticable to raise the line to give headroom for large vessels, swing bridges have been built, and this is no child's play. The swing bridge at Old Trafford is the heaviest of its kind ever constructed. The Moore Lane bridge is another fine bridge of the cantilever type. The arms are respectively 140 feet and 98 feet long, it measures 25 feet wide inside the girders, and the swinging weight is about 700 tons. The diversion of the Bridgewater Canal is another remarkably interesting piece of engineering. The canal crosses the Irwell at Barton upon the aqueduct which was considered such a triumph of engineering skill when it was built a century ago. The level of the Bridgewater Canal is some feet above that of the Manchester Ship Canal, and as it is impossible either to lower the former to the level of the latter, or to raise it some seventy feet, Mr. Leader Williams adopted the bold idea of building a swing aqueduct. The work was rendered still more difficult by the fact that the Bridgewater Canal crosses diagonally, thus introducing the complication of a "skew" aqueduct. The Ship Canal is widened at this point to make room for the center pier upon which the aqueduct pivots. The swinging aqueduct is not the only complication at this part of the Ship Canal. It was very desirable to have communication between the Bridgewater Canal and the Ship Canal, and this is accomplished in the following curious manner: A kind of siding, or backwater, with water-tight gates at either end, has been built to the Bridgewater Canal. The vessels are floated into this, the gates are shut, and the whole thing is lowered by hydraulic machinery to the level of the Ship Canal, into which the vessels are then floated. By the reverse process vessels can be lifted from the Ship Canal into the Bridgewater Canal. The dock work, not only at the terminus at Manchester, but along the route, is very extensive, and includes large docks at Warrington, Salford, and a coal basin at Irlam.

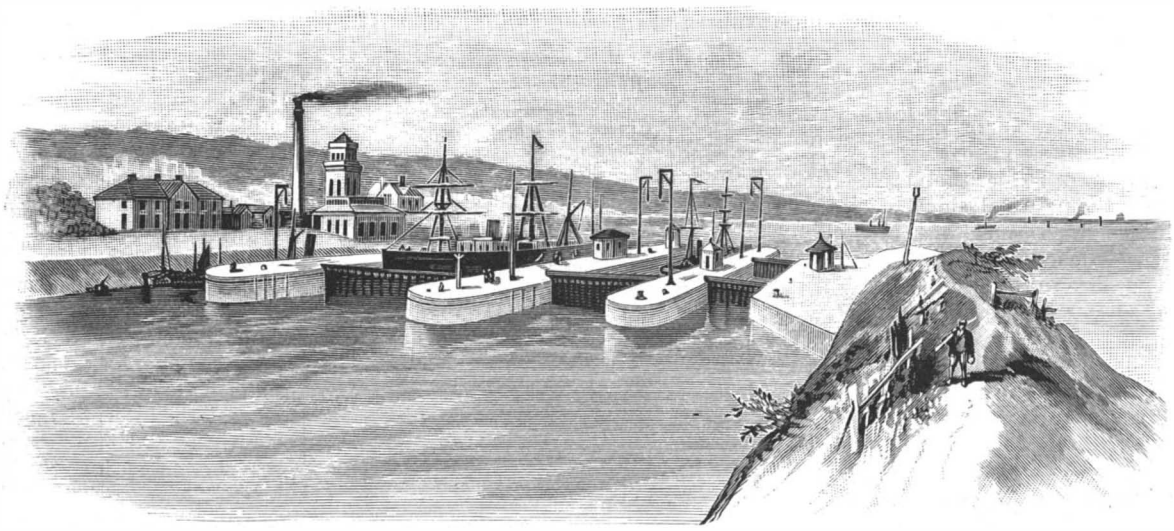
Works and jetties are being rapidly constructed along the banks, and it is not difficult to imagine, as Mr. E. Leader Williams (engineer-in-chief) aptly pointed out, that before many years have passed the canal will be practically converted into one long dock.

The Bridgewater Canal is carried over the ship canal by means of a steel aqueduct 235 feet long, 6 feet deep, and 19 feet wide, and weighing 1,900 tons. It swings on its pivot as quickly and as easily as could be imagined.

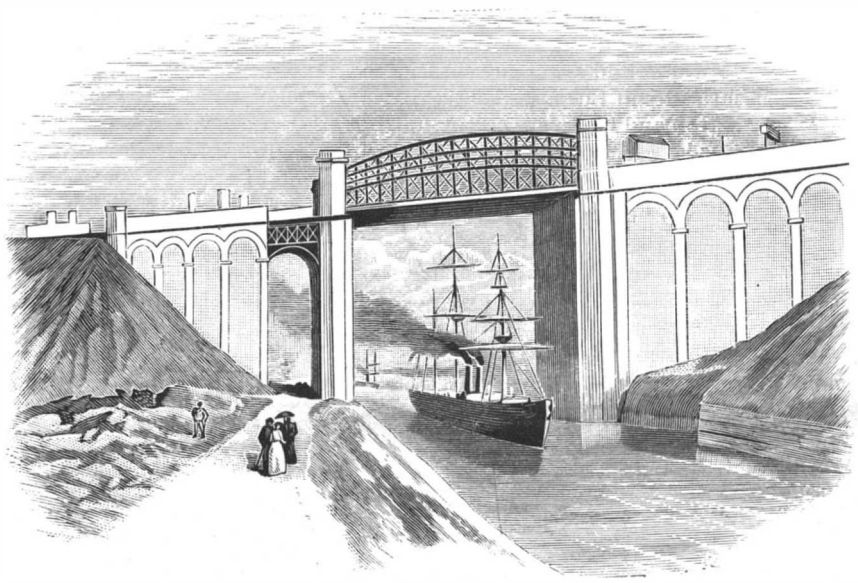
The Salford docks, which, like those of Manchester, are fitted up with every appliance for the speedy loading and unloading of vessels, have 71 acres of water space, divided into three immense arms, 1,350 feet, 1,177 feet, and 828 feet long and 225 feet wide.

The Manchester docks have been built on the site of the old Pomona Gardens. These docks have a water space of 33½ acres, have four arms, one 620 feet long, and three 571 feet long, and the Ordsall dock opposite is 980 feet by 750 feet.

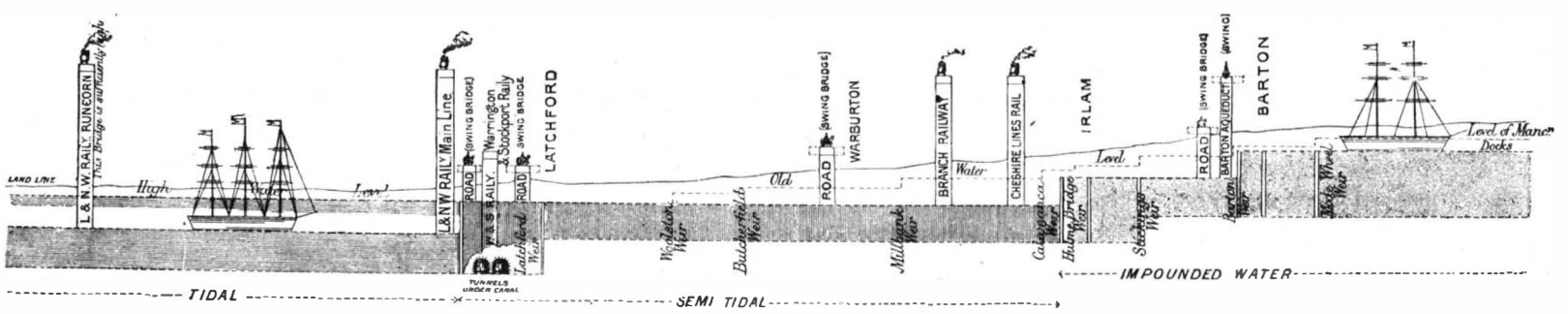
The late Mr. Daniel Adamson, it is now generally conceded, was the originator of the present scheme for the building of the great canal. The chief engineer of the work was Mr. E. Leader Williams. The enterprise was financed and supported by many of the leading merchants and men of enterprise in Manchester.

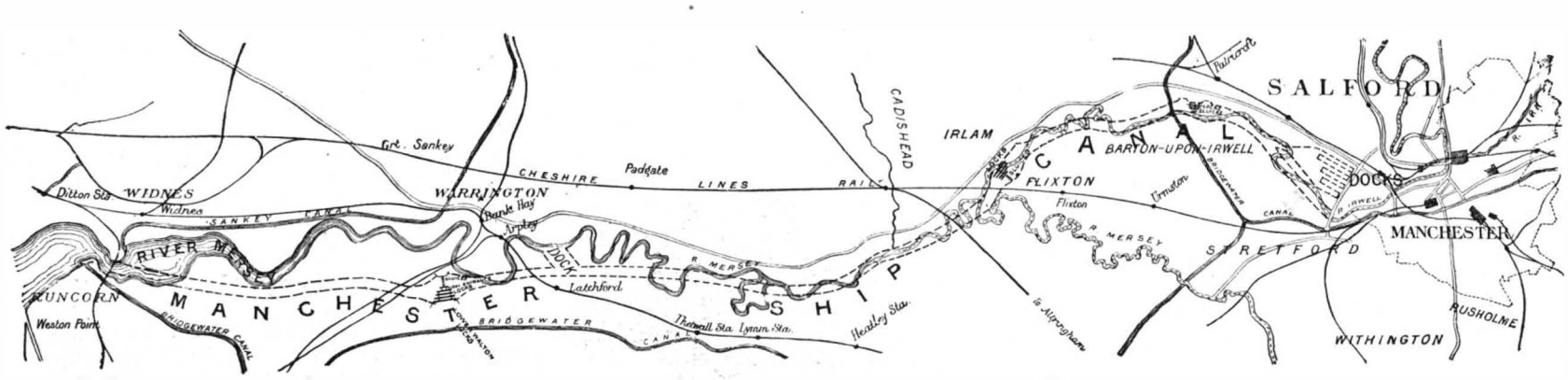


THE MANCHESTER SHIP CANAL—EASTHAM LOCKS AT THE ENTRANCE OF THE CANAL.



THE ACTON GRANGE VIADUCT OVER THE MANCHESTER SHIP CANAL.





THE MANCHESTER SHIP CANAL.

How to Cover Pulleys with Paper.

Paper pulp of the ordinary kind is made into sheets about one-half inch thick. The sheets are cut up into strips, each strip being the width of a pulley, probably six inches. Of course, there are pulleys of all widths, but the experiments have been tried with six inch pulleys. Next the precise diameter of the pulley is obtained, and the strip of paper board, which is yet not thoroughly dry and so is pliable, is cut off about four inches longer than that. Now comes a little delicate work. With a sharp, broad-bladed knife one end of the board is opened like a V and the other is shaved down to fit into it.

ROME was supplied from twenty-four large aqueducts, which brought 50,000,000 cubic feet of water daily into the city.

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The Private Palace Car.

It costs about $50 a day, says the *Philadelphia Times*, to hire a completely furnished and palatial dwelling house on wheels, containing seventeen beds. In front is an "observation room." Next come two drawing rooms, both fairly spacious. Behind these is a dining room twelve feet long. The middle part of the car is occupied by berths, which are comfortable sofas during the day. In the rear are a good-sized kitchen, a china closet, a pantry, a bathroom and a cold storage closet. All linen for table and beds, tableware, crockery and every other necessary are supplied. Three servants are provided, also without extra charge—a skilled cook, a waiter and a porter, who are under the orders of the tenant. Heating and lighting are thrown in. After ten days the rental is somewhat less per diem.

Thus luxuriously housed, the occupant can travel wherever he wishes all over the continent by paying the railways eighteen fares for transportation. However, if more than eighteen passengers are carried in the car, so many extra fares must be paid. He can stop at whatever points he desires and have his car side-tracked.

If he chooses he can bring along his own servants, linen, tableware and wines. He is at liberty to furnish the commissariat himself, or the company will supply everything in that way for him, charging only 15 per cent over and above cost and rendering to him the bills. The latter is by far the better plan, inasmuch as trouble is saved and affairs are attended to more satisfactorily by the company.

The cook is always a capable person, and, having a time schedule for a journey across the continent, he will telegraph ahead to various points for such luxuries as may be obtainable at the markets in different cities, thus arranging for fresh fruits, butter and eggs, and even for a newly cut bouquet to be put on the table.

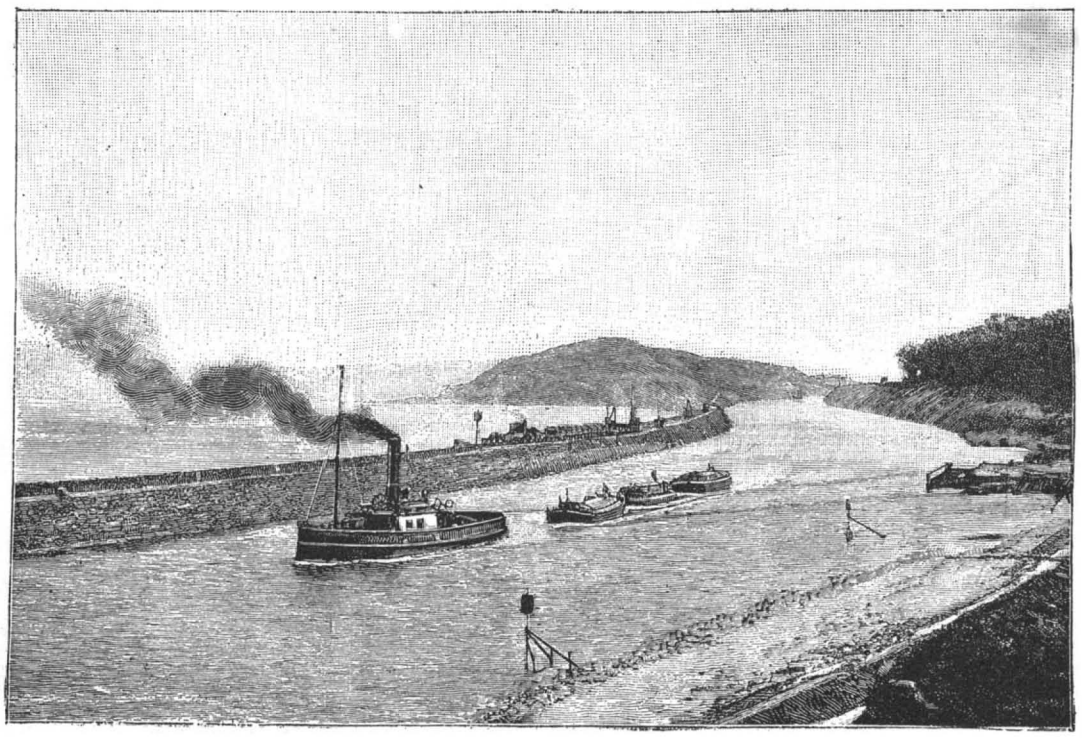
All this is susceptible of variation. One can engage an ordinary sleeping car for $40, a sleeping car with buffet for $45, or dining and observation car combined for $40. A hunting car, provided with kennels for dogs, racks for guns, fishing tackle, etc., costs only $35 a day. Service and all incidentals are thrown in.

But one can do better than this if he has plenty of money to spare. He can hire a complete traveling hotel for $210 a day, in the shape of an entire train, consisting of four sleeping cars, a dining car and a "buffet smoker." An observation carmay be added at an expense of $40 more. The buffet smoker represents in some respects the highest development of the modern parlor car. It includes a bar, a barber shop, a bathroom and a library, wherein can be found books, writing materials and the newest magazines and pictorial and daily papers.

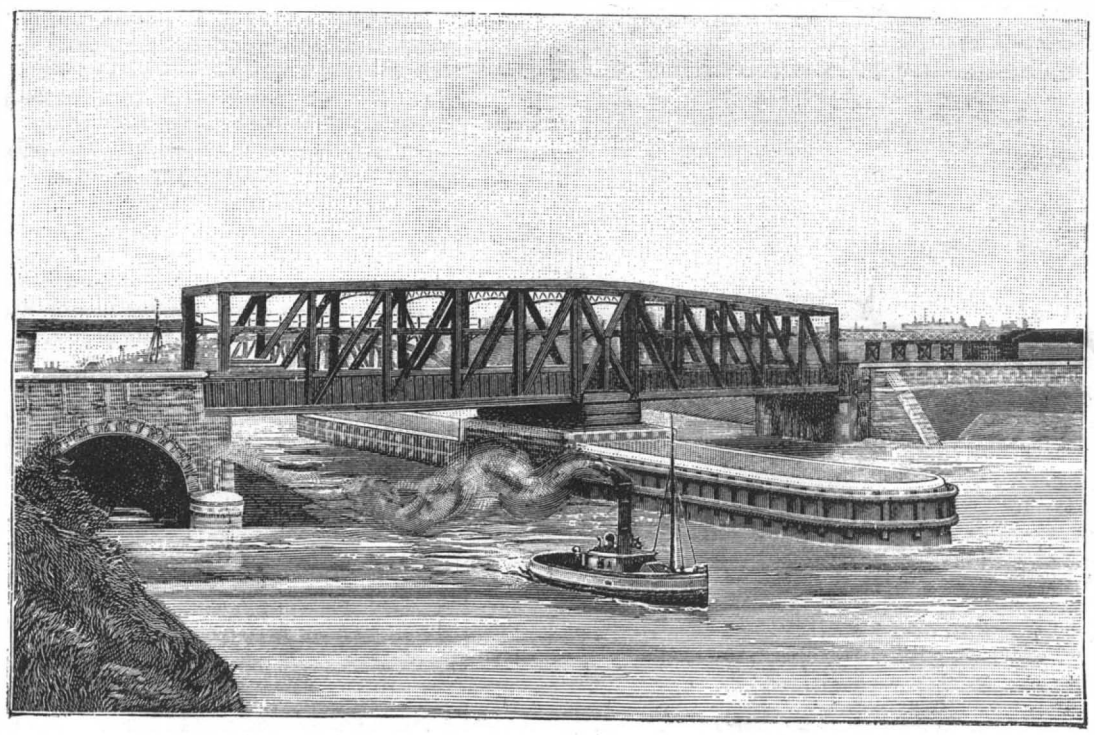
In short, it is a small club on wheels. There is no other country in the world where luxury in traveling is so highly appreciated as it is in the United States. Abroad it is said that the only people who go by rail "first class" are the nobility and the Americans. Of course, the person who charters a whole train must pay the railways for transportation at least eighteen fares per car, though west of the Mississippi the minimum rate is usually fifteen fares. No car can be rented for the prices above given for less than three days.

It has recently become the fashion for actresses to travel in private cars. Nowadays a conspicuous star usually insists on being provided with such a conveyance as part of the contract for a tour which she signs with her manager. Bernhardt always carries a small managerie with her, which could not very well be accommodated in a public vehicle. Theatrical companies very commonly hire cars while traveling.

Dining cars are usually owned by the railways and are managed by the palace car companies. Ordinarily they are run at a considerable loss, being attached to trains merely as an attraction to passengers. The expense of conducting them is enormous. To begin with, there are ten servants attached to each car. There is a steward, who has full charge--superintends everything, looks after the comfort of the guests, takes in the money for meals and makes reports to the company. He receives $100 a month. There are four cooks, because many dishes have to be prepared at once and without delay. The head cook gets $75 and the other three are paid respectively $55, $40 and $30 a month. The five waiters get merely nominal wages, depending chiefly upon tips for remuneration. For food the expenditure varies from $1,000 to $1,500 a month for each car.



VIEW OF CANAL NEAR EASTHAM.



BARTON SWING AQUEDUCT AS SEEN FROM THE CANAL.

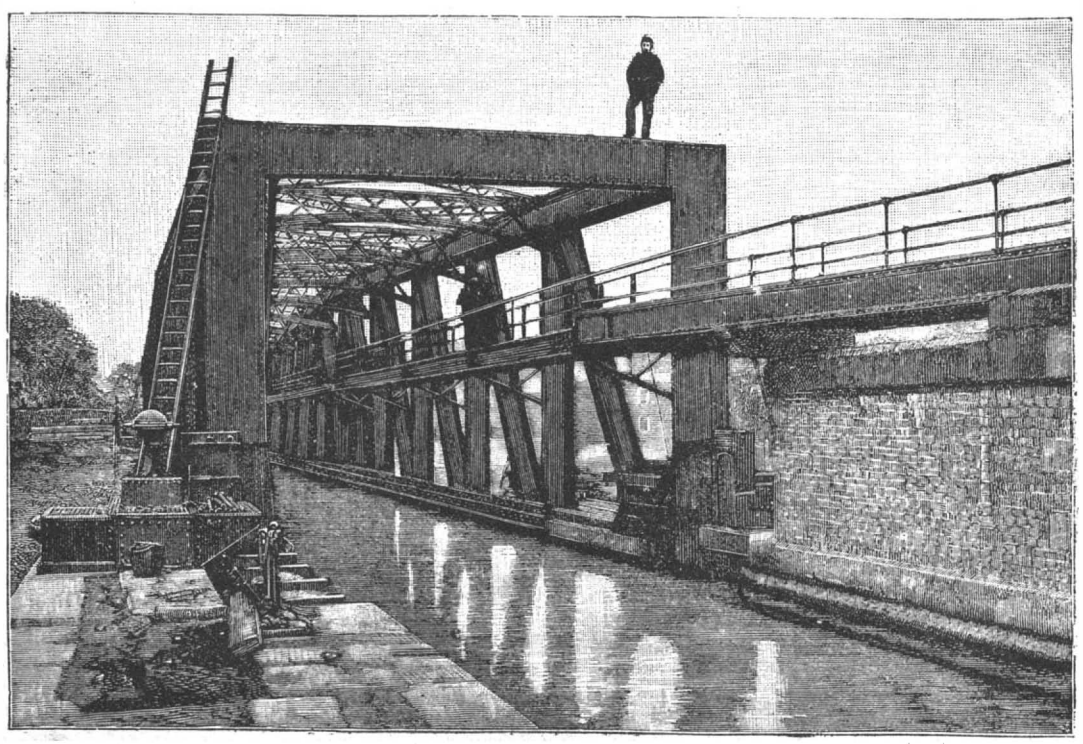
In different cities all over the country there are dealers from whom the company regularly buys provisions. The steward attends to this, paying cash always and rendering the receipted bills to his employers. At principal points, however, the company has salaried buyers, who supply the cars at starting, so that the stock of provisions need only be supplemented by the steward with perishable articles and in case that anything runs short. These buyers go to market every morning at 4 o'clock.

They select whatever is best, just as the steward for a hotel would do, purchasing at a considerable discount from regular prices. Each car has a kitchen like a hotel kitchen in miniature; also a pantry, a cold storage closet, a closet filled with wines and various liquors and an ice cream locker. Beneath is an ice box for meats which will hold 700 pounds.

According to the regulations, the steward is personally responsible for all dishes prepared. He must see to it that they are properly cooked and neatly garnished before serving. No chipped dish is to be used under any circumstances, nor any piece of table linen with a hole in it. In short, everything must be managed as in a first class hotel. As a rule, the meals provided on dining cars are better than can be got for the same prices at stationary restaurants. The charge for dinner is $1, and 75 cents for breakfast or supper.

On the basis of expenditure above given, it costs from $16,000 to $22,000 a year to run a dining car merely for food and wages, to which must be added wear and tear on the property and many incidentals besides. Thus it is not surprising that the business is a losing one.

Arrangements made between the palace car companies and the railways regarding sleeping cars vary very



THE MANCHESTER SHIP CANAL—BARTON SWING AQUEDUCT, CARRYING THE OLD BRIDGEWATER CANAL ACROSS THE SHIP CANAL.

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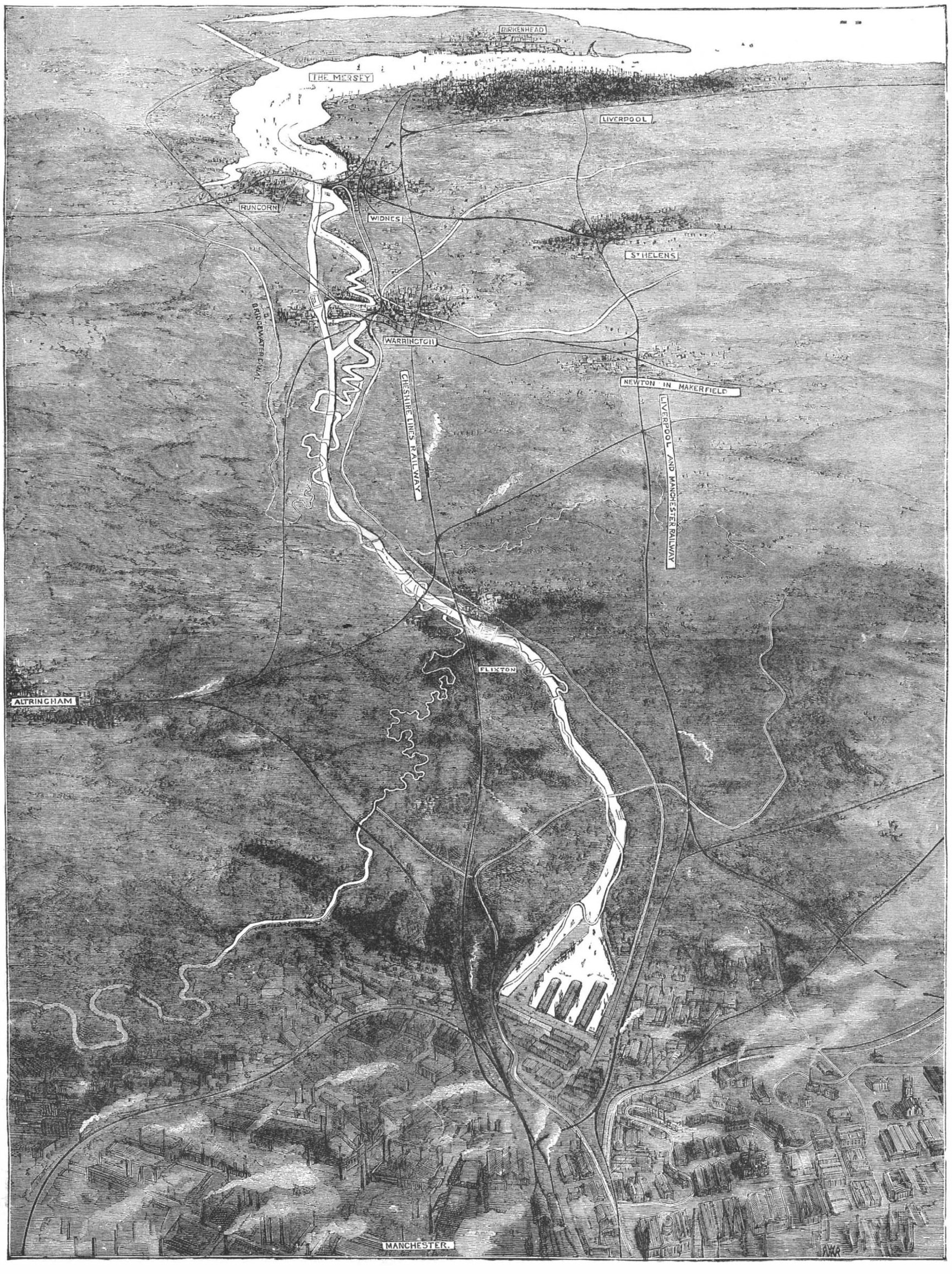
much. Sometimes the latter pay as much as two or three cents a mile for the use of each sleeper, where, as is particularly apt to be the case in the South, the passenger traffic is not sufficient to pay the car companies. In such cases a railroad is often obliged to provide the necessary convenience at a loss to itself. The item of washing is a very costly one in the running of sleeping cars, as no piece of linen is ever used twice without going to the laundry.

A sleeper, on leaving New York for Chicago or St. Louis, receives a "stock" of 120 linen sheets, 120 pillow slips and 120 towels. This gives change for two nights. Fifteen or twenty clean towels are always kept on the washstand. The washing is done in New York, Boston, Buffalo, Chicago, St. Louis and other cities, being given out in great quantities at the low rate of $1 per hundred pieces. An equipment of linen lasts about one year, at the end of which it must be renewed. It is purchased by wholesale, $50,000 worth at a time.

A Peculiar Accident.

A peculiar accident occurred at the Mt. Tacoma Manufacturing Company's mill in Tacoma on the morning of February 6, which is reported in the *West Coast Lumberman* as follows: Charles E. Tuttle, a logger in the employ of the mill, was directed to split a large cedar log lying upon the carriage, as it was too large for the saw. Tuttle stood on top of the log and drove a number of wedges into it, when the log suddenly parted and the unfortunate man in endeavoring to get out of the danger, slipped and fell into the opening between the halves. Before he could escape the pieces closed in upon him, leaving only his head outside. A number of workmen saw the accident, and the unconscious man was released by prying the log apart. At first it was thought that he had suffered internal injuries, but after a few days of rest he was able to resume work again.



THE MANCHESTER SHIP CANAL—BIRD'S EYE VIEW.

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NOTES ON THE DOMESTIC CAT.

(*Felix domesticus.*)

BY NICOLAS PIKE.

The Felidæ, or cat tribe, form one of the most natural and characteristic groups of the class mammalia. From the lion or tiger to the domestic cat, all are endowed with the same instincts, the same appetite, the same structure; carnivorous in the extreme, they are admirably framed for a life of rapine.

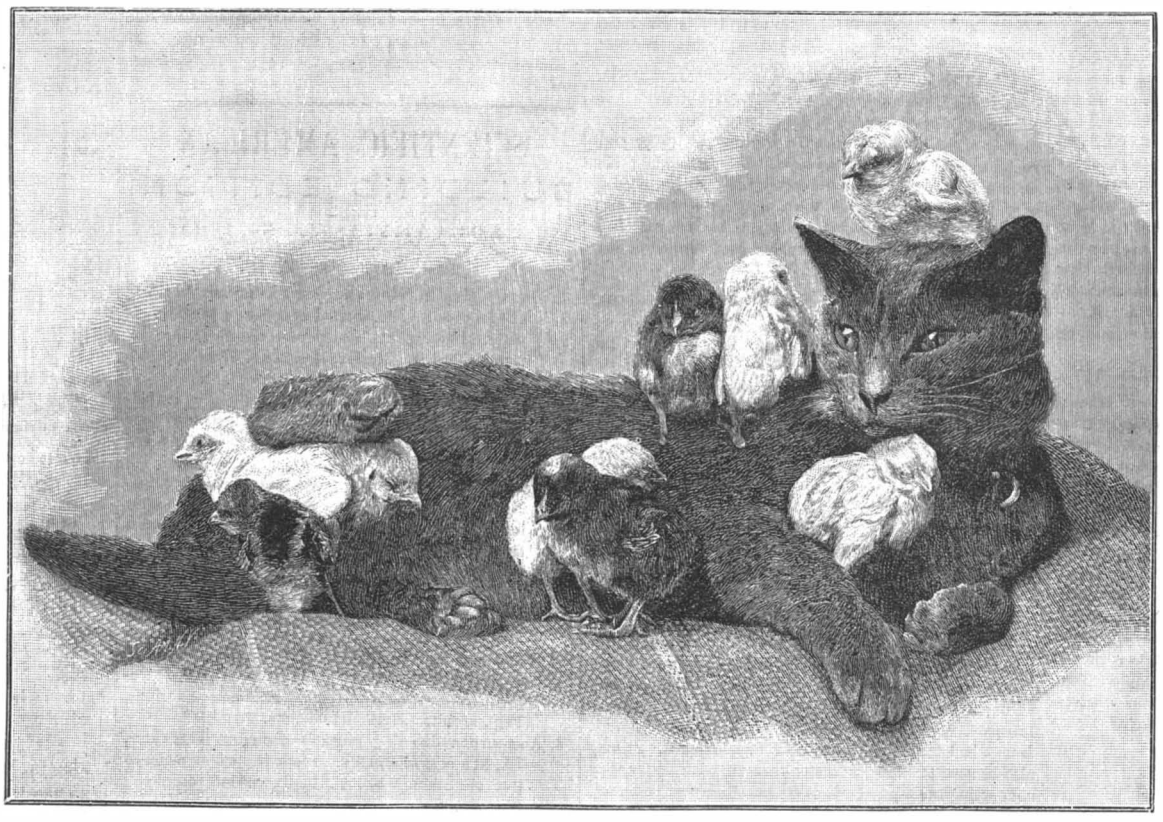
The feline race are concentrated in the warm latitudes—the species being fewer and more widely dispersed as we pass from the warm to the temperate or colder regions.

The origin of the common domesticated cat is supposed to be a species indigenous in Nubia, Abyssinia, and Northern Africa, and known by the scientific name of *Felix maniculata*. However this may be, the domestic cat was among the sacred animals of very early times, and there is no doubt but that it has been domesticated many thousands of years. The Egyptians held them as sacred, embalmed and placed them with their dead. They were sculptured on their tombs and monuments, and painted on their coffins. There are in the British Museum some Greek vases, dating to the fifth century before Christ, upon which were pictures representing domesticated cats like those of the present day. The cat, says Mr. Mill, in his history of the crusades, was a very important personage in the religious festivals of the times which he describes. At Aix in Provence, on the festival of Corpus Christi, the finest tom cat in the canton, wrapped like a child in swaddling clothes, was exhibited in a magnificent shrine to public admiration. Every knee was bent, and every hand strewed flowers or poured incense, and puss was treated in all respects as the god of the day. In the time of Hoel, the good king of Wales, who died in the year 948, laws were made to protect the cat, as it was of great importance on account of its scarcity. To steal or kill a cat that guarded the king's granary, the forfeit was a sheep or as much wheat as, when poured over the cat suspended by the tail (its head touching the floor), would form a heap high enough to cover the tip of the former. Great care at this time was taken to improve the breed of these prolific creatures. In all countries and places the domesticated cat is found. In Europe, Asia, Africa, and America, it is petted and made much of and becomes attached to its protector. Notwithstanding the statements made by writers that the cat never seems to be under subjugation—as it always acts for itself, all its views confined to the place where it has been brought up—this is a great mistake, as I shall show further on. Cats, I can positively state from my own observation, show as much affection to those who care for them as the horse or any other animal. In the latter part of the last century there lived an artist of the name of Mind, who was a most remarkable man. He was known to the world as the "Raphael of cats," as his whole time was devoted to painting these animals. No painter before him ever succeeded in representing them with so much nature and spirit as he did.

Each of his cats had an individual character and expression, and was in fact a portrait which seemed animated. He had a Maltese cat called Minette, which was his favorite cat, and his attachment to it was unbounded. Sometimes this cat would occupy his lap for hours, while three or four kittens would be perched on his shoulders. He called them the beloved companions of his solitude, whose complacent purrings seemed to him an ample compensation for the inconvenience. Mind devoted much time to his cats, and taught them to spring upon the door latch and open the door, and sit with him at the table while he was eating. He would play hide and go seek with them, and Minette always secured a position at the foot of his bed at night, and would growl if any stray footsteps were heard. When he was sick this favorite cat would not leave the room or take food. All the animals he had were exceedingly fond of him, and in many ways showed strong affection for him.

It is said that the world has taken 5,000 years to become familiar with cats; their nature and instinct are not yet, it appears, completely understood. Cardinal Richelieu was a great lover of cats, and in a room adjoining his bed chamber he had a number of cats which he used to play with every morning. History has preserved the name of most of his famous cats. Mohammed was also an enthusiastic admirer of cats. There is a story of one who found rest in one of his sleeves; rather than disturb it, he cut it off and let Tom have his sleep. To show the great affection of puss *The Feathered World* relates the following: "One of a brood of chickens was lame and unable to follow its mother in search of food. The chick was soon half starved. It was missed, and next day was found lying with three kittens, the mother of which gave the fledgling every attention. Every day the cat carried the bird in its mouth into the farmyard, where it obtained food, and as regularly conveyed it in the same manner back to lie with the kittens. Through the care of puss the injured limb grew stronger and the chick throve well. The conduct of the cat was a matter of great interest to the inhabitants of the farm, who carefully watched puss in all her movements."

We give a photograph of a young Maltese cat, with nine chickens, which she cares for with as much affection as their natural mother would. If one strays away from her, puss becomes quite excited and mews for it to return. The little chicks appear to be as contented as possible and nestle under her soft fur and go to sleep. When puss has her family around her and crawling over her body, she seems perfectly happy. Here is another case of strong affection which a cat displays for her mistress. A young woman was murdered in New York City a short time ago, and when discovered a large black cat, a favorite of the murdered woman, was found resting on her body. Her large fiery eyeballs glared ferociously in the dim light of the dingy apartment. When an attempt was made to remove the animal, it growled fiercely and showed its teeth in a wicked manner. Finally it was driven off, but took refuge under the bed, and could not be driven away. An examination showed that it had not attacked or injured the body in any way. It was probably prompted by the strong affection it had for its mistress, which caused it to nestle where it was found.



A CAT BROODING CHICKENS.

It would be useless for me to describe the common house cat, it is so well known. We will select such of its peculiarities that may have escaped the notice of the inattentive observer. The common house cat, *Felix domesticus*, brings forth its young twice a year. Her period of gestation is fifty-five days. Sometimes it may be a few hours longer. She will average four young ones at a birth. She is fond of concealing her kittens from the male, who often destroys them as soon as born, if an opportunity offers itself. If cats are well cared for, they will live about fifteen years, sometimes longer. Their vivacity, however, seems to diminish at six or seven years, indicating the fact that they have passed the bounds of youth. It is an intelligent animal and can, with kind treatment, be taught many things. We once had a fine Maltese kitten presented to us, which we brought up with great care. It grew into a beautiful large cat, full of intelligence. It learned to open the door, leap over a high back chair at command, would growl when strangers approached and dive through a hoop covered with tissue paper. Prince, for that was his name, made no friends, but his whole heart was concentrated in his mistress. He would sit in her lap for hours, and seemed always happy when near her. On the days of her departure, Prince was told that he must be good during her absence. When she left the house, he would perch himself upon a chair near a window till she was out of sight. About the time she was to return he would watch patiently and gaze up and down the street, and we always knew when she was coming by Prince leaving his post and rushing to the door to welcome her return. He received caresses from others under protest, and seemed to care for his mistress only. Some cats are natural actors and will enter into the spirit with as much zest and understanding of what is wanted as though they were human. At a meeting and exhibition of the Cat Breeders' Association in June last, at Boston, a famous trick cat, three years old, was exhibited dressed up in a gown and bonnet (her name was Muffins), who would pose herself to have her photograph made. Sometimes she would stand three minutes without moving, swing and perform on the trapeze, jump over a bar at the word of command; would jump through a hoop encircled with fire, shake hands, walk on her hind legs, and catch ball with a certainty that would delight Ward, the base ball champion.

One cat on exhibition rides a bicycle. It is a fine white Angora cat. When fairly started she becomes enthusiastic and urges her bicycle rapidly along, with an evident enjoyment that bystanders find contagious. The tabbies do housework to perfection, scrub little handkerchiefs and towels in a tub and hang them up to dry, skate on rollers, and all with such contentment and spirit that they seem like little children masquerading in fur.

The above statements are true, and very much more could be added to verify my statement of the great intelligence of a much abused and useful animal.

It is supposed that cats can see in the dark. In a moderate light the pupil of the eye of a cat is small and of an oval shape, and in the bright glare of the sun at midday it becomes narrow, but in the dark it becomes round and full, and is so expanded that it nearly fills the surface of the eyeball. The Chinese and some of the negro tribes in Africa often examine the eyes of their pets in order to ascertain the time of the day. Some of the East Indians can tell you very nearly the time of the day by this means. When Abbe Huc, a French Jesuit priest, traveled in China and Chinese Tartary, he mentioned the following: On asking his attendant the time of the day, he immediately went over to the cat that was basking in the sun and examined its eyes, told the Abbe that it was about two hours after noon, and on being questioned how he knew that, he explained that the pupil of the eyes were largest in the morning, and that they gradually grew smaller as the light increased until they reached their minimum at noon; that then they began to widen again, till at night they became large. In Sumatra, when there is a drought, and rain is wanted, the women of the village all go to the river scantily clad. They wade into the water and splash each other, then a black cat is brought and thrown in, and made to swim about for a while, then allowed to escape to the bank, pursued by the women, who splash the water after it. The color of the animal is part of the charm. Being black, it will darken the sky with rain clouds. In the middle ages it was deemed by the Romans an ill omen to meet a cat on the way to a wedding. The sneezing of a cat on the evening of a marriage was considered a good omen. A cat carried away from home will almost always find its way back. One taken from Brooklyn, Long Island, to Jamaica, a distance of 12 miles, returned in three days to his home. If a cat falls from a height it generally comes down square on its feet without any harm. I have known of two instances of cats falling over forty feet without injury.

From what has been written, it will be seen that cats have a great amount of intelligence and should be treated with consideration, for kindness to the brute creation is an attribute of a noble nature, while brutality toward them shows a selfish and cowardly disposition. If we worship Almighty God, let us be human to all his creatures. Cats have feelings like ourselves and show them much in the same way that we do sometimes. No animal, in my opinion, is capable of distinguishing with greater acuteness between friend and foe. A cat will often understand words with marked keenness.

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RECENTLY PATENTED INVENTIONS.

Engineering.

FURNACE TAP.—Edward P. Mathewson, Pueblo, Col. This invention provides means whereby the operator may drive an agitating bar into the molten metal in the hearth or crucible, without stopping the blast or otherwise interfering with the regular process of smelting. A casing fastened to the furnace front has a matte hole and a slag discharge hole, a slag casing being arranged over the matte hole in front of the first casing, and there being slag spouts adapted for vertical adjustment in guideways in the sides of the slag casing.

PISTON ROD PACKING.—Thomas J. Hudders, St. Paul, Minn. This improvement is adapted for use in an ordinary gland or stuffing box, and is arranged to adapt itself to any irregularity in the movement of the piston rod. A concave annular seat is fitted to the stuffing box cap, a sleeve with a collar at or near its center, having a concave surface fitted to the annular seat, and provided with internal circular grooves at opposite ends, while a spiral spring in the stuffing box is arranged to press the sleeve outwardly against the seat. A packing ring of circular cross section is fitted in the grooves. The labor and delay of packing a piston rod is thus obviated, and friction and wear are reduced to a minimum.

LOCOMOTIVE BOILER.—Thomas A. Henderson, Bucyrus, Ohio. This invention provides a readily removable baffle plate and an adjustable deflecting apron secured to its bottom, instead of the baffle plate riveted in the smoke box, according to the usual practice. Under the old method of construction, when a flue bursts, or repairs are needed, the removal of the baffle plate is a work of some hours, which time is saved by means of this improvement.

Railway Appliances.

AUTOMATIC AIR BRAKE COUPLING.—William A. and Benjamin S. H. Harris, Pelzer, S. C. Two patents have been granted these inventors for improvements on couplers formerly patented by them, the main features of the improvements consisting in coupling heads with self-acting valves and locking mechanism, in connection with a supplemental air pressure pipe extending at the side of the brake pipe throughout the train, whereby the brake pipe sections attached to different cars couple and uncouple automatically. When accidentally parting when the train is running the brakes are instantly applied, according to this improvement, not only to the separated cars, but to those that remain connected with the locomotive. The valves of the couplings may also be closed at will by the engineer, preventing the application of the brakes whenever desired. One of the patents is specifically for a new valve locking and releasing mechanism, whereby certain important advantages are obtained in the automatic application and release of the brakes.

STREET CAR FENDER.—George Hipwood, Horatio C. Barrett, and Stephen Porter, Boston, Mass. In lugs depending from either side at the front of the dashboard is journaled a horizontal shaft actuated through bevel gears by a rod provided with a crank handle, and at each end of the shaft is a hollow tube in which is held a spring-pressed rod, the rods being united at their forward ends by a cross bar, forming the outer end of the fender proper. Intermediate spring-pressed bars are also connected with the cross bar, beyond which extends a series of curved, pivoted shoes, cushioned at the rear, and with their forward ends resting on rollers adapted to roll on the ground. The spring-pressed frame is covered by a network, and the shoes are adapted to rock and throw back into the net, without injury, any one accidentally in the track of the car, the toes of the shoes coming down very close to the ground. The device folds up against the dashboard when not in use.

Agricultural.

PLANTER.—Robert B Ormiston, Winnipeg, Canada. This machine is especially adapted for planting cabbage, celery, onion, and similar seed or plants, making the necessary holes in the earth and depositing the seed or plant therein, and properly covering them as the machine advances. The cavities in the ground are made by a forward wheel, and the seed or plants are carried by pockets of a traveling belt, from which they are taken and deposited by fingers of a planting bar and the roots of the plant or the seed are covered by a covering bar. The machine is provided with markers, held out of operative position when not required.

COTTON HARVESTER.—Leonard R. Turner, Sing Sing, N. Y. This machine, in combination with a suitable driving mechanism, has a series of cylindrical fenders carrying whips, which swing in and out of the fenders, in their outward motion delivering blows upon the branches or bolls of the plant, thus loosening the ripe cotton and removing it to a conveying mechanism by which it is discharged into sacks, the unopened bolls being left uninjured for subsequent gathering after ripening.

Miscellaneous.

HOSE BRIDGE AND TOWER.—James Blake and Emil F. Begiebing, Union, N. J. This invention provides an improvement in devices to facilitate carrying a hose over a railway track, so as not to interfere with the free running of cars. The improvement comprises a telescoping body, extended by means of a crank and a rack mechanism, a hose holder being hinged to the top section of the body. It may be quickly and easily extended to make it the necessary height, and as readily folded and collapsed into a small compass. It may also be used by firemen as a tower, from which streams may be advantageously directed into the upper stories of buildings.

DUMPING RACK.—William Underwood and Cornelius Prall, Fair Grange, Ill. A dumping rack which may be attached to the running gear of an ordinary wagon after the body has been removed is provided by this invention, whereby a large load of broom corn and similar material may be carried, and the load readily dumped as desired. A rearwardly extensible fender is arranged to project beyond the tail end of the rack body, to engage and secure the rearwardly projecting portions of the load.

PNEUMATIC TIRE REPAIRER.—Charles E. Buckbee, Flushing, Mich. For repairing punctured pneumatic tires or other rubber tubes, this inventor utilizes a flexible tube for holding rubber cement, the cap of which is provided with a tubular needle, which the cement will follow into the puncture as the tube is squeezed, until the cement accumulates as a small button on the inside of the tire, after which the needle is withdrawn and the tube gently squeezed to supply sufficient cement to fill the puncture and tightly seal the opening.

LIQUID MEASURE.—Harold Gregson, Detroit, Mich. A piston is held to slide in a cylinder having suitable inlet and discharge ports, a handle being connected with the piston and a gauge rod arranged at one side of the handle, while an indicator on the handle moves opposite the rod. The measure is adapted for use with any kind of liquid, however light or heavy, the measure simultaneously filling on one side of the piston as it discharges on the other, as the handle is moved in and out, and the measure being always full so long as the supply of liquid lasts.

PORTABLE PERFUME RECEPTACLE.—Gustavus A. Ritter, New York City. This is a device in the form of an opera glass, and with similar tubular sliding extensions, but of such peculiar construction as to afford two liquid holders adapted for a separate discharge of their contents, and which may be separately sealed in a convenient manner. It is also designed to be carried in a case similar to that of an opera glass, and be appropriately finished, affording a unique and neat design.

BAG OR PURSE FRAME.—Louis B. Prahar, Brooklyn, N. Y. A latch for frames of this kind, devised by this inventor, is of such construction that the frame may be unlatched and opened with one hand only, the device being very simple, strong and inexpensive. A spring-pressed bolt projects above a housing attached to one member of the frame, there being on the other member a keeper on which slides a cap to which is secured a pin working in the keeper and adapted to engage the bolt.

PLATE AND CUP AND SAUCER HOLDER.—Oscar L. Miller, Ravenna, Neb. This is a device of simple and durable design to facilitate the advantageous display of table ware, permitting the articles to be conveniently attached to and removed from the holder. The plate holder is formed preferably of a single piece of wire, bent to the required form, and with which may readily be connected a second plate holder, as well as a hanger, and a cup and saucer holder, each formed of single pieces of wire.

GLOVE.—Henry M. Peyser, Boston, Mass. According to this improvement, two tapes are secured in a peculiar manner to the glove at one side of the slit, to facilitate the closing in of the inner heads of the buttons in a sheathing, at the same time insuring the proper sewing up of the several parts forming the sheathing. The sheathing is thus very conveniently formed without any stitching being seen on the outside.

LIFTING FORK FOR KITCHEN USE.—George M. Parsons, Virginia City, Nev. This is a simply made device to facilitate the lifting of hot dishes. It is strongly made of a single piece of wire, so bent as to enable a variety of different shaped dishes to be readily grasped thereby and handled as desired without danger of breaking the dishes or burning the fingers.

MOSQUITO NET FRAME.—Albert C. Lottman, Houston, Texas. This is an improvement on a formerly patented invention of the same inventor, providing a very simple and inexpensive frame, with but few parts, which may be readily attached to or removed from a bedstead without injuring or marring it. It may also be used to support a tester or frame with its canopy connecting the tops of the posts in a four-post bedstead, facilitating the carrying of the netting over the bed or over the headboard without interfering with the tester.

BOTTLE COVER OR CAP.—Antenor Assorati, New York City. This device consists of a shank capable of a sliding movement in relation to a clip spring upon the receptacle or a bottle neck, a counterbalanced cover being pivotally connected with the shank, and means for holding the latter in place after it has been adjusted. When the bottle or other receptacle to which the device is applied is in an upright position, its mouth will be effectually sealed, but as the receptacle is inclined its mouth will be uncovered.

ANIMAL TRAP.—Newton J. Tanner, Oviedo, Fla. This is a trap which, when sprung, will jump bodily upward, thus raising the jaws so as to make sure that they catch on the leg of the animal springing the trap. It is also provided with a series of hooks which extend outward beyond the free ends of the jaws and overlap, the hooks catching and holding the animal should it escape the jaws as they come together.

EAVES TROUGH HANGER.—Allen R. Lewis, Shelton, Wash. This is a hanger which may be adjusted horizontally and vertically and it may also be adjusted to receive eaves troughs of different widths, or attached to an inclined eave, holding the trough horizontally. It is simply and strongly made, and may be quickly and easily put in place.

DRAIN.—John L. Steitz, Chicago, Ill. This invention relates to stop and waste devices used in cold weather to drain water supply pipes and prevent their freezing. The drain is intended to be used in places where the water pressure does not exceed twenty pounds, the pressure being used to compress air to operate the device. The device is entirely automatic, and during warm weather may be rendered inactive by turning a stop cock.

BADGE HEADING DESIGN.—Edward L. Torsch and James R. Lee, Baltimore, Md. This is a novel form of clasp pin frame, of oval shape and special marginal configuration.

DESIGN FOR EXHIBITION STAND.—Isaac Hermann, New York City. A mirror exhibition stand, designed by this inventor, has vertical panels at right angles to each other, with horizontal figures in retreating, step-like form partially intersecting the panels.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

ENGINEERING EDUCATION. Being the Proceedings of Section E of the World's Engineering Congress, held in Chicago, Ill., July 31 to August 5, 1893. Published by the Society for the Promotion of Engineering Education as Volume 1 of their Proceedings. Edited by De Volson Wood, Ira O. Baker, J. B. Johnson, Committee. Columbia, Mo. 1894. Pp. viii, 342. Price $2.50.

A society for the promotion of engineering education exists in this country, and in this volume we have the first volume of its proceedings. It includes a number of excellent papers on college education, such as the place of mathematics therein, systems of examination and other practical features thereof. These papers are by prominent educators, and discussions on them are introduced. The volume is largely a report on the work done in the direction of engineering education at the International Congress of Engineering held at the World's Fair in Chicago. There is no question that the proper system of engineering education is a problem of the day, and how better to reach a knowledge of its different conditions than by the perusal of such volumes as this is not easy to see. The volume lacks an index, something which would add very greatly to its value.

"The Shoe and Leather Reporter Annual" for 1894 is the title of a solid octavo volume of 773 pages, affording the most complete directory anywhere published of the boot and shoe manufacturers and dealers, tanners and curriers and leather sellers, and those engaged in related branches of business. The lists of names for the United States and Canada cover about all that could be desired and the volume also includes the principal houses in all other parts of the world. The book likewise contains valuable trade records and statistics.

SCIENTIFIC AMERICAN BUILDING EDITION.

FEBRUARY, 1894.—(No. 100.)

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1. Elegant plate in colors showing a suburban dwelling at Plainfield, N. J., erected at a cost of $4,800 complete. Floor plans and perspective elevation. A tasteful design. Messrs. Rossiter & Wright, architects, New York.
2. Plate in colors showing an elegant residence at Pelham Manor, N. Y. Perspective view and floor plans. Estimated cost $7,000 complete. An excellent design.
3. The Jamaica Club House, recently erected at Jamaica, N. Y. Perspective views and floor plans, also an interior view. Cost $9,000 complete. Messrs. Haus & Oborne, architects, Brooklyn, N. Y.
4. A beautiful residence at Portchester, N. Y., recently erected for A. V. Whiteman, Esq. Perspective and floor plans. Mr. Frank W. Beall, architect, New York.
5. Engravings and floor plans of a suburban residence erected at Ashbourne, Pa., at a cost of $4,800 complete. An attractive design. Harrison Allbright, Esq., architect, Philadelphia, Pa.
6. A suburban dwelling recently erected at Edgewater, Ill., at a cost of $10,216. Floor plans and perspective elevation. Mr. F. B. Townsend, architect, Chicago.
7. A colonial cottage at Buena Park, Ill., recently completed for Guy Magee, Esq. Floor plans and perspective elevation. An artistic design.
8. A modern half-timbered cottage at Wyncote, Pa., erected at a cost of $4,250 complete. Floor plans and perspective elevation. Mr. A. S. Wade, Philadelphia, Pa., architect.
9. A modern colonial residence at Oak Lane, Pa., erected at a cost of $6,800 complete. Perspective view and floor plans. Mr. F. R. Watson, of Philadelphia, Pa., architect. An attractive design.
10. The residence of Rev. Samuel Scoville at Stamford, Conn., erected at a cost of $6,616. Mr. W. W. Kent, architect, New York. An excellent design.
11. Examples of interior decoration and furniture in the Moorish style.
12. A Queen Anne dwelling at Jenkintown, Pa., recently completed at a cost of $5,000. Messrs. Burke & Dolhenty, Wyncote, Pa., architects.
13. Miscellaneous Contents: The growth of plants in odd places.—Acoustics in buildings.—Improved steam power brick machine, illustrated.—A new style stamped ceiling, illustrated.—The telethermometer or distant temperature indicator.—The improved Thatcher furnace, illustrated.—Improved sash chains and fixtures, illustrated.—An improved sliding door latch, illustrated.—Aluminite in cement plaster.—Fire losses of 1893.—Graphite paint.—The Columbian sash and door lock, illustrated.—An improved sash lift, illustrated.

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Stave machinery. Trevor Mfg. Co., Lockport, N. Y.

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Air compressors for every possible duty. Clayton Air Compressor Works, 26 Cortlandt Street, New York.

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The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Nickel-in-slot machines perfected and manufactured Electrical supplies, Waite Mfg. Co., Bridgeport, Conn.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

Carborundum—hardest abrasive known. Send for prices of wheels, powder, etc, The Carborundum Co. Monongahela, Pa.

Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.

Split Pulleys at Low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Thos. Pray, Jr., box 2728, Boston, Mass. Testing Steam Power, Waterworks Pumping Engines, Steamships, etc. Write for advice, charges, information.

U. S. patent of a new combined heater, cooler and ventilator for sale. (Agents need not apply.) Address Emil F. Ruehr, inventor, 420 W. 3d St., Davenport, Iowa.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5842) W. C. K. writes: Some people claim that if you will make a noticeable mark upon the trunk of a young tree, the mark will always remain the same distance from the ground as when made. Now, is this a fact? And if so, can you explain? A. Our forest trees are supposed to have a slight rise in the lower parts of their trunks by reason of the expansion and uplift of their roots, so that marks on the bark near the ground may rise a few inches, or a foot or two, in the course of its growth. Some kinds of trees rise more than others.

(5843) O. H. P. writes: 1. What is the power of the motor described below, if the proper current is applied? The field magnet is the same as the one described in SUPPLEMENT, No. 641, for simple electric motor, excepting it is wound with 2¼ pounds of No. 24 magnet wire and No. 18 on armature and connected in shunt. A. About ⅛ horse power. 2. Is there any change you recommend in the motor to increase its efficiency? A. No. 3. What change should be made to make it an efficient dynamo for incandescent lighting? A. Cast iron fields and finer winding. 4. How many, and what voltage and candle power, should the lamps be? A. The voltage depends on the winding. It should give 10 or 12 candle power. 5. I have made a storage cell with thirteen plates cast of lead, 6 inches long, 4 inches wide, ⅛ inch thick, with forty ½ inch holes in each plate. The surface of the plates is roughened with a knurl and the holes were well filled and the surface coated with a paste of red lead. How many such cells will be required to develop ⅛ horse power for one hour at a time in the motor described? A. Ten. 6. Should the cells be connected in series or in parallel? The cell I have made will run the motor without load for four hours. A. It depends on the winding. For your winding connect in series. 7. How many 6×8 gravity cells will be required to charge the storage cells that I may use the motor one hour each day at full capacity? A. 26 cells in series and 5 in parallel, a total of 130 cells. 8. What would be the effect if the zinc in a gravity cell were amalgamated? A. It is not necessary, and involves loss of mercury. 9. If the positive plates in the storage cell described were ½ inch thick, would it have a greater amperage? A. No. 10. What should be the specific gravity of the acid solution for the storage cell I have made? A. 1,170 before charging, 1,200 or 1,210 after charging.

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(5844) L. B. asks: 1. Which requires more voltage, an induction coil having a core of one bar of soft iron, or several wires, to obtain the same results, using the core as a magnet for the circuit breaker? A. The wire-cored coil will work the best in all respects. 2. Could the "Little Giant" water wheel advertised in your paper run the hand power dynamo described in "Experimental Science," and how many eight candle power incandescent lamps could it light? A. Yes. The dynamo would run only a small lamp. 3. In how many ways can the induced currents of an induction coil be regulated? If made with a stationary core (which operates circuit breaker) would it be advisable to use a tube, or would it be advisable to have the secondary coil movable, and which is the best and quickest means of winding a coil? A. By moving one of the coils, by moving the core, by shielding the core and unshielding, by changing the current intensity, and by cutting out some of the secondary. The shielding tube method is by all means the simplest. 4. How many volts does one ½ candle power lamp require? A. 3 to 4½ volts. 5. How many volts will heat a No. 36 platinum wire ⅝ inch long? A. It depends on the temperature to which it is to be heated.

(5845) T. H. D. asks: 1. Why is it that some bricks will freeze and disintegrate and others will not? I know that what is designated as a hard brick will not break up on being frozen, and that soft brick will. Also that there is a sandy clay in some localities, especially about our sea coast, which will upon being properly burned produce hard bricks that will stand the exposure and freezing all right and yet are really softer and more porous than the soft brick made of the clay of our river bottoms; they will absorb three times the amount of water the others will, and yet not disintegrate when frozen. Why is this? A. It is a matter of chemical composition. Some clays develop a higher cementing quality, and one less affected by moisture. 2. Will you please state the per cent of loss in heat-giving properties of Tennessee bituminous coal if it is stacked out in the open air for one year? A. Possibly 10 percent.

(5846) C. E. H. asks: 1. How many and what size zinc and carbon bichromate cells will run an intensity coil of the following dimensions to its full extent? Length 8 inches, diameter of core ⅝ inch, in the primary coil 4 layers or 1 pound of No. 16 cotton-covered copper wire, secondary coil of 14 layers or 2 pounds of No. 25 cotton-covered copper wire, all wire well insulated. A. Four cells quart size. 2. What size condenser had I better use? A. Three or four square feet of tin foil. 3. What will be the voltage of the secondary coil when working to full extent? A. Divide turns of secondary by turns of primary and multiply by 4. 4. Will it give any spark, and if so, of about what length? A. Possibly one-sixteenth inch.

(5847) C. T. V. asks: 1. What becomes of a current of electricity generated by a dynamo after it has passed through a number of lamps? A. A current of electricity cannot be treated as a material that flows. As far as the analogy holds, it flows around the circuit without break. 2. Also if a number of lamps are being supplied by a dynamo and all are turned off, the generator continuing in motion, will any danger be done? And why? A. No. 3. Again, if 50 lamps are being fed from a generator, and 25 are cut off or only 1 is left burning, what would be the result and why? A. It depends on how the generator is wound. The remaining lamps if the dynamo is shunt wound get too much current, and too little if it is direct wound. If compound wound they may be but slightly affected. 4. Will you please send names of storage battery manufacturers. Also your opinion as to their practicability. A. Address the Brush Electric Company, Cleveland, O. They are very practicable.

(5848) W. T. M. asks: 1. How can I keep the fluids of a gravity battery separate without the battery being in action? A. You cannot. It is better to draw off a few inches of the upper layers with a syringe or siphon. 2. Is there any paint that will stick to an iron propeller wheel that will keep it from rusting? Would pitch, or a mixture of pitch and oil, or gas tar do? A. Use marine paint. 3. How fast could I drive a 5 by 30 launch with two 3 by 4 engines at 150 pounds pressure? A. Perhaps 6 or 8 miles an hour. 4. If an unjacketed boiler would hold with a certain fire 100 pounds steam, any valve being wide open, what might I expect if boiler was jacketed so it would be cool to touch? A. 125 pounds more or less.

(5849) Van B. V. asks: 1. Will you please give me a receipt for keeping flour paste from souring when it is made in large quantities? A. Add 20 grains of salicylic acid to each 12 ounces of water used. 2. Also inform me if there is not a method of making the paste without cooking it? And if so, how is it made? A. Flour paste should be cooked.

Wheaten flour	1 oz.
Powdered tragacanth	½ "
Powdered gum arabic	½ "
Salicylic acid	30 grn.
Oil of wintergreen	3 drops.
Water	12 oz.

Mix the powders and gradually add the water, then bring to the boil, allow to simmer for twenty minutes, stirring constantly. When cold add the oil. 3. Please inform me how mouth glue is made? A. Fine pale glue 1 pound, dissolve over a water bath in sufficient water, add brown sugar ¼ pound, continue the heat till amalgamation is effected, pour on a slab of slate or marble, and when cold cut into squares.

(5850) B. K. asks: 1. What is the latest and best definition for electricity, if any? A. There is no good definition. One of the most recent is: "An imponderable and invisible agent producing various manifestations of energy, and generally rendered active by some molecular disturbance, such as friction, rupture, or chemical action." This is from the "Standard Dictionary of the English Language." 2. What also is the nearest correct theory as regards the magnetism of the earth? A. Ampere's theory holds that currents of electricity circulate around it approximately parallel to the equator. 3. Could or would you refer me to which one of your issues contains the best descriptions of Brush electro dynamo? A. See our SUPPLEMENT, No. 274, and SCIENTIFIC AMERICAN, No. 19, vol. 69.

(5851) C. W. Y. asks (1) the number of gravity cells (Crowfoot) required to light a one candle power incandescent lamp. I wish to use it in a dark room lantern and for other purposes. A. 64 cells. 2. Where can I obtain carbon pencil (one-sixteenth inch diameter) for electric lamp described on pages 512 and 513 "Experimental Science"? A. Address dealers in electrical supplies. 3. Least number of gravity cells and least number of Grenet cells required to run same? A. About 20 Grenet or several hundred gravity. 4. Where can I get iron for telephone diaphragm spoken of in SCIENTIFIC AMERICAN? A. Use ferrotype plate. 5. Can I buy the carbon buttons used in Blake transmitters? A. No.

(5852) C. A. S. asks for a cheap finish for wood. A. A cheap polish to brighten hard oil-finished work after being rubbed.

Gum shellac	1 oz.
Gum arabic	¼ "
Gum copal	¼ "

Powder and sift through a piece of muslin, put them in a closely corked bottle with 1 pint alcohol, in a warm place, shaking every day till the gums are dissolved, then strain and bottle.

(5853) M. K.—To make oiled silk.—Coat your silk with boiled linseed oil to which gold size has been added. Give three coats of the oil, drying thoroughly between each coat.

(5854) W. J. B. asks: Do the electric or trolley cars affect a watch in its running? It is argued by some that it does and by others that it does not. I have a fine watch. When I go on the trolley cars I leave it home, which is a great inconvenience, for fear it would be injured by electricity. The above has caused a great deal of argument at my place. A. It is doubtful if it will to any extent, practically speaking. If afraid, carry your watch in an iron box, such as a blacking box.

(5855) W. S. M. asks: I have been told by nautical men that a vessel encounters a drag when sailing through shallow water, even though it may not be within several feet of the bed of the ocean or stream. Is this a fact, and if so, why? A. This is true. The vessel drags water after her, and the bottom wave is impeded and more energy is expended on the water than if there were more depth.

(5856) J. G. L. asks: 1. What steel can take the greatest charge of magnetism? Also if the steel has to be hard or soft? A. Use tool steel. Straw color to blue temper. 2. In charging a piece of steel in an electric circuit, what is the best way to wind the wire around it, whether diagonal or straight? A. As straight as possible.

(5857) X. Y. Z. asks: 1. Where can I get details how to make a 2 horse power motor to be run by battery? A. Our SUPPLEMENT, No. 600, gives a 1 horse power motor; our SUPPLEMENT, No. 865, a 5 horse power. These are the nearest we have. 2. How many cells of carbon acid battery will it take to run same? A. Allow 500 quart cells to one horse power. 3. What will be the amperage of 50 cells (carbon acid batteries) connected in series? A. Two amperes, about.

(5858) E. B. S. asks: 1. Can a 50 volt motor be made to run on a 500 volt street car circuit? Can it be done by introducing a large amount of resistance in circuit? The motor can, if required, stand 75 volts. A. By winding with very fine wire or by introducing a resistance in series, about nine times that of the motor. 2. Also, what size fuse wire will protect a No. 22 copper wire, American gauge? A. Use a piece of No. 23 wire.

(5859) C. D. M. asks: 1. How many storage batteries and what size plates shall I have to use to run a two candle power lamp about two hours each day? A. Three cells in series, with 24 square inches of positive plate in each cell. 2. How many gravity cells, and how long will it take to charge them? A. Eight gravity cells in series would require several days. By putting 18 in parallel and 8 in series you could charge in 10 hours. 3. How long would it take to charge 2 storage batteries with 5 gravity cells? The plates of the storage batteries are to be coated with red lead. A. It depends on the size of the plates.

(5860) A. B. C. asks: 1. Please tell me through the columns of Notes and Queries what SUPPLEMENT you have that will tell how to make a small dynamo that will light two 16 candle power lamps (incandescent). A. See SUPPLEMENT, No. 844, for nearest approach to your size. 2. What would be the voltage of a dynamo one-half the size of the one described in SUPPLEMENT, No. 600? A. It depends on the winding. For calculations see Sloane's "Arithmetic of Electricity," $1 by mail. 3. What is the cause of the shadows seen on a frosty window at night when there is a strong light, as an arc light, opposite the windows? A. It may be due to network around the globe or to stains in and deposits on the glass of the globe.

(5861) E. C. D. asks: 1. What amperage would a storage battery give that has two positives and three negative plates 7 x 8½ of the pasted kind? A. 4 to 5 amperes. 2. How long will a storage battery of three cells connected in series, the plates 3 x 5 and two plates to each cell, burn a two candle power lamp continually, before the battery has to be recharged? A. The battery will not do the work. For other queries address the author of the book referred to.

(5862) W. A. H. asks: A grocer uses a false weight of 15 ounces instead of a pound. What per cent does he gain by his dishonesty? What per cent do his customers lose? A. 6⅔ and 6¼ per cent respectively. Your other query is insufficiently stated.

(5863) C. S. W. says: Will you please tell me if there is a premium on a large copper cent dated 1841? A. Yes. The coin is worth 5 cents, if in good condition.

(5864) B. D.—Aluminum is about as elastic as silver; it does not compare well with steel as regards elasticity.

(5865) W. J. S.—The dimensions of a hole made in a block of metal would be increased on heating the block.

(5866) C. W. — Use maple for violin bridges.

(5867) A. C. F.—A good red ink is as follows: Pure carmine, 12 grains; water of ammonia, 3 ounces; dissolve, then add powdered gum, 18 grains; ½ drachm powdered drop lake may be substituted for the carmine where expense is an object.

(5868) J. B., Alaska, asks why the streams of water in that country freeze at the bottom; it is a common occurrence here in the creeks and flumes or ditches to see from two inches to one foot of ice on the bottom and a strong flow of water on top of it, in fact the water often overflowing the banks; after a time the ice will become loose and lifting gravel and bowlders will float down the stream. This generally occurs in the early winter, October and November, after which time it does not occur. A. The freezing of water at the bottom of streams in severely cold weather is the anchor ice so well known to millmen and in the quick-running streams of the northern United States and Canada. It is well known that quick-running water or water in agitation does not commence to freeze at a temperature just below the freezing point, but may reach a temperature even lower than 25° before ice crystals begin to form. A quick-running stream at this temperature may not freeze at the surface from agitation, but will cool the bed of the stream or the projecting stones to its own temperature, at which temperature the thin film of water in contact with the stones or bottom freezes to the surface and continues to keep the icy surface at the temperature of the running water, and so accumulating the icy coating at the bottom until a change in temperature changes these peculiar conditions. The thickness of the anchor ice in time ceases to convey the freezing temperature to its point of contact with the stones or ground, and the earth heat melts the contact surface and the buoyancy of the ice raises it from the bottom.

(5869) B. M. asks: What portion of its traveling distance will the piston of a steam engine travel over at a quarter stroke of the crank? A. At quarter stroke the crank is at 45°, the versed sine of which is the travel of the crank pin in the central line of motion of the piston. Calling the crank one, or one foot, the sine of 45° is 0·7071 +, the versed sine is 1—0·7071 = 0·2928 + which as the total piston travel is twice the length of the crank makes $\frac{0{\cdot}2928+}{2}$ = 0·1464 + of the total stroke due to the crank position. To this must be added the gain by the position of the connecting rod, which if of six times the length of the crank, then the square root of the square of the length of the connecting rod minus the square of the sine of the crank radius, subtracted from the length of the connecting rod, is equal to the versed sine of the connecting rod as radius, or as above the $\sqrt{6^2 - 0{\cdot}7071^2} = 5{\cdot}995$, and 6—5·995 = 0·005 + 0·1464 = 0·1514 in proportion to the whole stroke. Or for an engine of 2 foot stroke with a 6 foot connecting rod the piston will have advanced 3·63 inches when the crank is at 45°.

(5870) F. M. G. asks: How can an engineer find the water level in a boiler when the water is foaming? A. If the glass water gauge is properly connected by the use of a stand pipe connected with the top and bottom of the boiler, the mean of the oscillation of the water in the gauge will indicate the solid water level in the boiler. If there is no water gauge, the gauge cocks should give a safe indication of the solid water level by a slight opening and noticing the character of the discharge. The bottom gauge cock should show less sputter than the top one. The difference is easily noticed and with a little experience may be relied on.

(5871) "Reader," Yarmouth, N. S., writes: Pipe improperly laid from source of supply weakens our water pressure. It is proposed to improve it by pumping and storage. One proposal is to put up a two million gallon reservoir, the water level of which would be 150 feet above high tide, or no higher than highest points of town. This would, however, improve pressure in lower parts of town, and in case of fire an electrically worked gate would divert steam pumps from the reservoir directly on to the main. The second proposal is to put up a steel or iron standpipe, to store 600,000 gallons, the highest level of which would be 100 feet higher than reservoir, also to be kept full by pumping. Both proposals are advocated by experienced men. Would reservoir or standpipe be best, under circumstances described, for both fire and domestic purposes in town of 8,000? Is lack of durability in standpipes compared with reservoirs a good reason for condemning standpipes? A. The highest part of the town does not explain the desired point required as to the merits of the reservoir or standpipe plan. If it means the street level, the standpipe offers the only way of supplying the houses in the upper part of the town. If the house top level, is meant, the reservoir plan is the most desirable, as great pressure is not desirable on account of the plumbing work in the lower part of the town. With the standpipe 100 feet higher than the reservoir would, as we understand you, make a pressure of over 200 feet head in the lower part of the town, which would be a cause of danger to the plumbing work. If a standpipe is adopted it should not be over 50 feet above the house tops of the upper part of the town, which should be sufficient for fire service. The reservoir offers the safest and most satisfactory plan, if it will supply the houses in the upper part of the town by gravity, on account of the large surface storage with its ready and ample supply for a fire department.

(5872) F. S., Winnipeg, asks: What is the latest improved and best equipped system of heating, ventilation and water closets for public schools? A. For your climate steam heating by the duplex system is most satisfactory. The severity of the long winters requires direct radiation in the exposed parts of the school rooms or under the windows. Coils of pipe along the walls being preferable to radiators as a better distributor of heat, and of about half the quantity to properly heat the rooms. The balance of heat should come through hot air flues from basement coil heaters for ventilating the rooms. Water closets should receive heat through air flues from basement coils only, with a special view to ventilation. All rooms should have ventilating flues on each side, as far as possible from the hot air flues, with registers at both top and bottom of the rooms. The bottom registers only to be used in extremely cold weather.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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February 27, 1894,

AND EACH BEARING THAT DATE.

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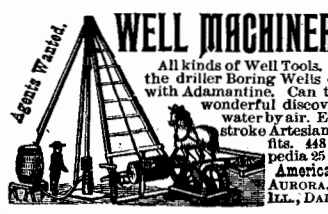

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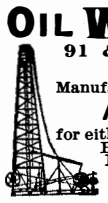
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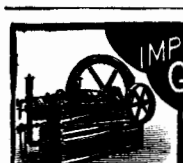
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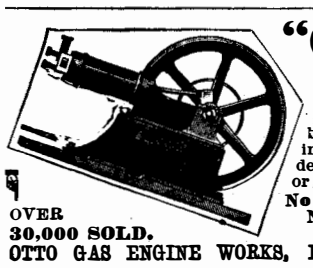
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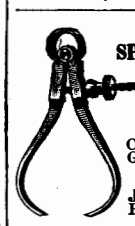
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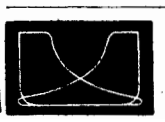
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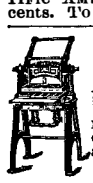

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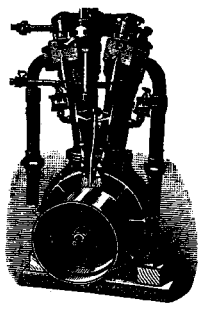

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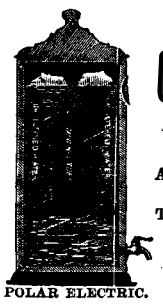

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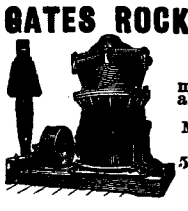

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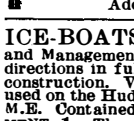

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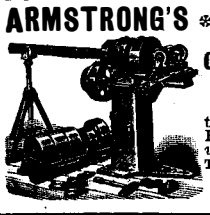

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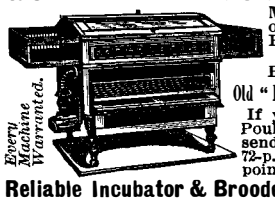

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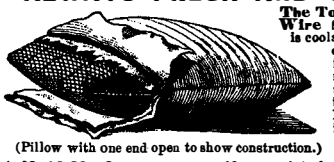

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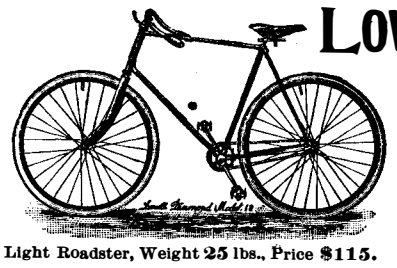

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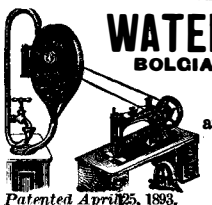

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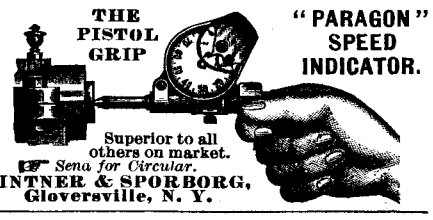

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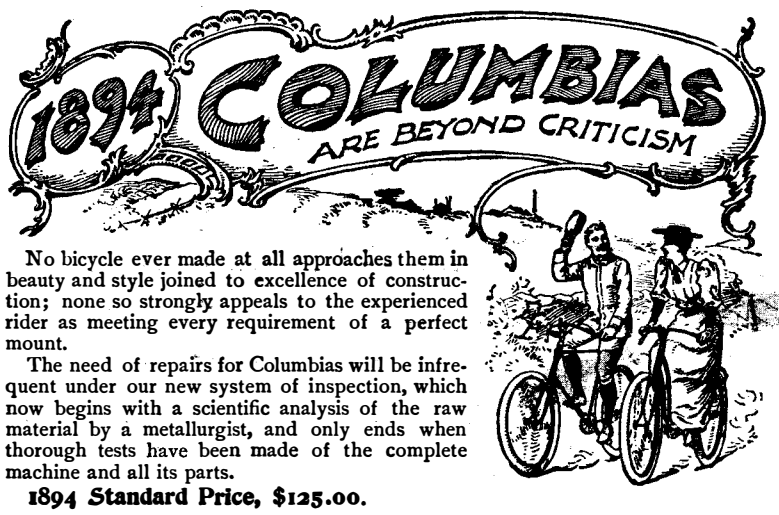

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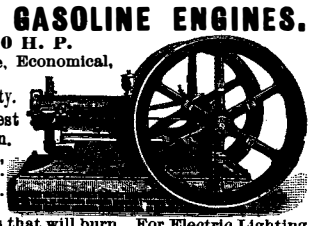

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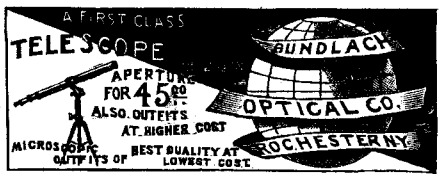

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